The Alternative Space: Informal Settlements and Life Chances in Belém, Brazil

By

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Abstract

Informal settlements have usually been seen as chaotic and disordered spaces in cities of the developing world and, from the elites' perspective, something to be ashamed of. There is a great deal of knowledge about their economic causes; however, little is known about the underlying spatial structures of these settlements or about how much spatial variables influence inhabitants' decision to settle in these precarious environments.

A theoretical framework was designed in order to allow a bottom-up approach to the research, able to take into account the inhabitants' motivations and achievements during the process of informal settlements' spatial transformation and integration into the formal city. The framework was built upon the concepts of poverty and of life chances. The latter is defined by Darhendorf (1979, 1988) as a person's long term prospects, brought about by choices between available options and according to his/her social objectives. The concept is constituted of three elements, entitlements (lawful means of access), provision (material supply) and ligatures (all types of human motivation). Socio-economic variables were selected as indicators of life chances' enhancement, and were subjected to tools of analysis from different branches of urban morphology and space syntax, to build a spatial dimension to life chances. Cross-tabulation between the socio-economic and the spatial variables was used to assess the potential of life chances delivered by the space of the five case study areas investigated, each one presenting a different stage along the process of consolidation. This thesis views the process of consolidation as resulting from the association between location, configuration, timescale and actions of different agents.

Overall, the evidence suggests that informal settlements in Belém are a negotiated response to a context of inequality, scarcity and inhabitants' desire for integration into urban life. These settlements present a fragile balance between people and space; the exploitation of the natural environment and reliance on social networks give the means to acquire provisions that would never be possible otherwise. The space of informal settlement is flexible, organised and potentially well linked to the existing city; but it needs the help of other agents to be consolidated. There seems to be an optimal synchronisation between minimum improvements to attract the better-off who earn money outside the settlements, and maximum provision that should not exceed the poorest's affordability limit.

The research combines spatial and socio-economic theories, unveiling their potential for successful practical application. The spatial approach associates different techniques of analysis created in different branches of urban morphology, contributing to their integration as a set of tools for professional involved with urban design. The research findings highlight the importance of physical standards and solutions adopted by upgrading actions in informal settlements, and provide evidence on which to ground government and funding agencies' changes in priorities and procedures of upgrade.

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Abbreviations

BID – Inter-American Development Bank (Banco Interamericano de Desenvolvimento)
BNH – National Housing Bank (Banco Nacional de Habitação)
CEF – Federal Economic Caixa (Caixa Economica Federal)
CELPA – Electric Centrals of Pará (Centrais Elétricas do Pará)
CODEM – Company of Metropolitan Development of Belém (Companhia de Desenvolvimento Metropolitano de Belém)
COHAB – Housing Company of Pará State (Companhia de Habitação do Pará)
COMAC – Coordination of Communitarian Action (Coordenação de Ação Comunitária)
DAGUA – Guamá Administrative District (Distrito Administrativo do Guamá)
DATASUS – Health System Databasis (Base de Dados do Sistema Único de Saúde)
DAU – Department of Architecture and Urbanism (Departamento de Arquitetura e Urbanismo)
DEQ – Department of Chemical Engineer (Departamento de Engenharia Química)
FAR – Floor Area Ratios (Índice de Ocupação)
FASE – Federation of Organasations to Social Development and Education (Federação de Órgãos para Assistência Social e Educacional)
FGTS – Compulsory Savings over Time of Employment (Fundo de Guarantia por Tempo de Serviço)
GDP – Gross Domestic Product
IBGE – Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística)
IPEA – Applied Economic Research Institute (Instituto de Pesquisa Econômica Aplicada)
IPPUR –Institute of Research and Regional and Urban Planning (Instituto de Pesquisas e Planejamento Urbano e Regional)
JICA – Japan Internation Co-operation Agency
LCCU – Complementary Law of Urban Control (Lei Complementar de Controle Urbanístico)
MW – Minimum Wage
NGO – Non-government Organisation
OECD – Organisation for Economic Cooperation and Development
OP – Participatory Budget (Orçamento Participativo)
PDGB – Plan of Development for Great Belém (Plano de Desenvolvimento da Grande Belém)
PDU – Belém's Master Plan (Plano Diretor Urbano)
PEM – Metropolitan Structure Plan (Plano de Estruturação Metropolitana)
PEMAS – Strategic Plan for Abnormal Settlements (Plano Estratégico Municipal para Assentamentos Subnormais)
PMB – Belém Municipality (Prefeitura Municipal de Belém)
PNAD –National Survey Household Sample (Pesquisa Nacional de Amostragem por Domicílio)
SEDU – Presidency of Republic's Special Secretariat of Urban Development (Secretaria Especial de Desenvolvimento Urbano da Presidência da República)
SEGEP – Planning and Governance Municipal Secretariat
SERFHAU – Federal Service of Housing and Urban Control (Serviço Federal de Habitação e Urbanismo)
SESAN –Municipal Secretariat for Sanitation
SEURB –Municipal Secretariat for Urban Control (Secretaria Municipal de Urbanism)
UFPA – Federal University of Pará (Universidade Federal do Pará)
UFRJ – Federal University of Rio de Janeiro (Universidade Federal do Rio de Janeiro)
UNCHS – United Nations Centre for Human Settlements (present UN-HABITAT)
ZEIS – Zones of Special Social Need (Zonas Especiais de Interesse Social)
ZH – Residential Zone (Zona Habitacional)

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To Gabriela and her generation

Chapter 1
Introduction

If you choose to believe me, good. Now I will tell how Octavia, the spider-web city, is made. There is a precipice between two steep mountains: the city is over the void, bound to the two crests with ropes and chains and catwalks. You walk on the little wooden ties, careful not to set your foot in the open spaces, or you cling to the hempen strands. Below there is nothing for hundreds and hundreds of feet: a few clouds glide past; farther down you can glimpse the chasm's bed.

This is the foundation of the city: a net which serves as passage and as support. All the rest, instead of rising up, is hung below: rope ladders, hammocks, houses made like sacks, clothes hangers, terraces like gondolas, skins of water, gas jets, spits, baskets on strings, dumb-waiters, showers, trapezes and rings for children's games, cable cars, chandeliers, pots with trailing plants.

Suspended over the abyss, the life of Octavia's inhabitants is less uncertain than in other cities. They know the net will last only so long.

(Calvino, 1997: 75)

Chapter 1 Introduction

1.1. The purpose of this research

The purpose of this research is to investigate whether choices made regarding space in informal settlements in Belém have contributed to the enhancement of their inhabitants' long term prospects, or life chances. The research focuses on the multidimensionality of the concept of life chances to better grasp the inhabitants' understanding of disadvantage and poverty, usually different from that of professionals. This is to find how much the space informally created is used to either compensate for or overcome poverty over time.

Dahrendorf (1979) firstly defined the concept of life chances as individual freedom to choose from the chances offered, guided by social objectives, taking into account the need for understanding the meaning of the multiple choices available in the European context of the time. The cited social objectives are provided by social ties and institutions such as family, religions, parties, and social classes, and were called *ligatures*. In 1988, Dahrendorf presented life chances as available options which are expressed both in their *entitlement* and *provision* dimensions, completing a three dimensional concept, based on the recognition of the inequality existing in the world as a result of unbalanced structures of power.

Kempen (1994) applied Dahrendorf's concept to study the role of space in the concentration of poverty in a Dutch city. Entitlements were then considered as access to social benefits, provision was taken as the urban fabric related to physical localities, and 'ligatures' were defined as the availability of information, related to access to knowledge. In this research, entitlements cannot be associated with access to social benefits provided by a welfare state, since within a developing country context social benefits are never fully achieved (Medeiros, 2001). Instead, entitlement is understood as access to the basis of human capital – education and health, and therefore to better work and income. Provision is associated with housing and infrastructure supply conditions, and ligatures with social networks and trade-offs practised by informal settlement inhabitants, since in the literature on poverty it is acknowledged that the poor consider qualitative factors such as independence, security, self-respect, identity, nature of relationships, decision-making freedom and legal political rights as important as quantitative access to income (Wratten, 1995). They also acknowledge that the ability to manage their assets is more important than the amount of assets initially available (Moser, 1998).

The framework provided by the three dimensions of life chances allows a broader understanding of what it means to be poor at the present (in terms of provisions, entitlements and ligatures

resources). It also makes possible the use of spatial analyses drawn from the fields of architectural and geographical research (presented in section 1.5) to measure the contribution of space to entitlements, provision and ligatures, especially relevant to contexts of poverty and strong inequality.

In this sense, the concept of life chances provides a framework to investigate people who have created the informal space, and the influence of this space on these people's lives, as required by a middle-ground approach to space, called by Soja (1980) the socio-spatial dialectic. In this, space is neither the means nor determinant of people's lives, but continually shapes possibilities in a two-way process (Hillier, 1996).

1.2. Background

Belém is a medium-sized capital city located in the Brazilian Amazon region (see Fig. 3.2, p. 50). Its trajectory over the 20th century tells the typical history of a wealthy city (according to regional standards) located in an economic frontier of a developing country. Belém's distance from the country's most important cities was the reason for its wealth, due to its strategic location, and also for its poverty. It used to be a port for exporting Amazonian products, connected straight to European centres; it flourished during the rubber boom occurring in the last decades of the 19th and the first decades of the 20th centuries. After the end of the economic cycle of natural rubber exploitation the city was impoverished, but with enough economic vitality to keep the region's independence from the Brazilian Southeast. During the 1950s a national project of integration was launched with the construction of Brasília and of a system of roads integrating the isolated regions with the Southeast, the densest and more industrialised portion of the country (IPEA/DAU, 1997; Browder & Godfrey, 1997).

The modifications in transport patterns were followed by big economic projects, designed during the military dictatorship initiated in 1964. These projects had, among others aims, the one of populating the Amazon, and transforming the region into a frontier of development. This caused massive migration and rapid urbanisation along the roads to the Amazon, attracted by the poles of mining and wood exploitation. It also caused peripherisation of the existing cities in the region, especially the biggest ones, such as Belém and Manaus. Belém Metropolitan Region presented a growth rate of 3.69% annually between 1970 and 1991, double the country's growth rate during the same period (Browder & Godfrey, 1997:126).

The municipality of Belém experienced fast urbanisation without correspondent economic growth; its periphery had an impressive population growth of 11.33% during the 1980s (Trindade,1998:15). As the biggest state capital in the region, it became a centre of services provision, even for the

population of surrounding states, prompting high levels of migration of deprived populations towards the city. Locally, the process peaked during Brazilian democratisation, opening up during the 1980s, which resulted in the aggravation of populist relations of power in the newborn democracy.

Moreover, the inadequacy of policies to meet the demand for low income housing and the prevalence of a typical 'modern' paradigm in existing official policies, through which only the average-income urban population's demands were taken as references for housing policies, led the newcomers to create informal settlements. These settlements were formed on either public or private unoccupied land, often thought unsuitable for occupation due to their waterlogged conditions. They were considered marginal, and relocation of squatters to official settlements was seen as the best solution, indicating a physical-ecological perspective on the problem, in which the space used was considered as a cause of the problem, rather than as a manifestation of it (Valladares, 1983).

Such a conservative approach and the conspicuous socio-spatial inequality of Brazilian cities favoured the adoption, from the 1960s onwards, of Marxist approaches in reflections on and research in urban studies, which offered a great deal of explanation of the process of production of Brazilian urban and regional space within the capitalist system. During the early 1980s, following that intellectual trend, many sectors of society gave political support to the low income people's struggle for housing; this consisted of endorsing the claim of tenure ownership[1] on occupied land. Spatial aspects, such as better integration of informal areas to the formal city, or physical and social infrastructure provision, were not emphasised in the prevailing political agenda (Alves, 1997).

This is an example of the 'blindness' of Marxist-oriented analyses to elements of the smallest scale of the built urban form, constituted by street patterns, blocks, plots, local land uses and buildings. Those analyses were usually concerned with mass level maps, either taking unrealistic views of the existing space (any change would be possible), or taking space as an end-product of social processes. Investigation usually stopped precisely when it was about to see the effect of the process of settlement creation on the everyday life of inhabitants. The observation of this fine grain space as an object to be planned for on a long-term basis might be considered conservative or favourable to the maintenance of the status quo (Souza, 2001) and incompatible with the Marxist agenda (Bica, 1984), and therefore was neglected.

However, space is acknowledged by its endurance and capacity to survive the process that generated it (Rossi, 1989; Hall, 2000) and the evidence that it is not a neutral basis for human action shows that it deserves attention if we are bound to tackle inequality in Brazilian cities

[1] In this context tenure ownership was understood as property of land.

(Holanda, 1997). The 1980s were a decade of economic adjustment and worsening poverty in Brazil, with increasing growth of all types of informal occupation of space (such as squatter, invasion and clandestine settlements). Nevertheless, the 1988 Constitution advanced the recognition of the social function of the city and individual basic rights and guarantees. This promoted the achievement of more entitlement by Brazilians, and favoured a more holistic perspective on the housing provision problem, despite the slow implementation of instruments related to urban reform in Brazil.

1.3. The research problem

The relationship between urban socio-economic and spatial variables is central to the problem of this research. Much of the literature on urban form-related studies has been developed in the stable socio-economic context of developed countries, and because of that cannot simply be transferred to developing countries (Bentley *et al*., 1985; Cannigia & Maffei, 1995; Moudon, 1997; Cozen,1969). Cities in developing countries such as Brazil are growing at incredible rates, and often up to half of their size has been informally produced, due to housing shortage and increase of urban poverty (IPPUR/UFRJ/FASE, 2001).

The problem of informal settlements was the object of more comprehensive inquiries during the 1970s, including investigation into settlements' spatial organisation. However, the identification of structural causes of the process of informal settlement formation (in macroeconomic conditions imposed on developing countries) oriented subsequent research to the study of policies, concerned either with forms of legally registered ownership or, more recently, with the relationship between the public and private agents involved in housing production (Payne, 1977, 1984, 1999).

Considerations related to town planning appear to have been thought secondary, since the biggest effort was directed to land ownership solutions and the relationship between agents involved in the production of urban land. Current solutions such as provision of site and services and upgrading of existing settlements are discussed in terms of their economic viability, but not in terms of the correspondence between spatial solutions and inhabitants' socio-economic and cultural needs. The literature seldom shows how the layout of a site and services has been defined, or how it was based on what premises; India was found to be an exception, presenting advances in the integration of socio-economic and spatial approaches to tackle low income housing problems (Vikram & Scriver, 1999; Correa, 1985; Steele, 1998).

In the Brazilian experience, it has been acknowledged that the economic and tenure ownership perspectives have not been enough to avoid maintenance of spatial inequality between the formal and the informally-generated cities (IPPUR/UFRJ/FASE, 2001:16). When spatial standards of

upgrade interventions are a-critically transferred from formal areas to informal ones, the poor inhabitants are expelled from the settlements, and upgraded areas are redirected to lower middle class segments of society, who are also constrained by housing shortage. When minimum standards are applied to upgrade actions, the benefited settlements are often condemned to carry the marks of their initial poverty forever, clustering inhabitants in areas poorly served by and poorly integrated with the formal city (Rolnik,1997; Trindade, 1998).

Certainly the socio-economic causes of this problem are the strong existing inequalities between rich and poor, and between centre and periphery (on regional and urban scales) in Brazil, as explained in section 1.2, and the inadequacy of official action to enhance equity nationally and locally. The side-effects of inequality in the city have been the object of attention of national researches promoted by official institutions such as IPEA/DAU (1997), IPEA (1997) and IPPUR/UFRJ/FASE (2000). In Belém, Lima's (2000) research was dedicated to the assessment of how much local urban policies have contributed to providing social equity in the city and found, among other things, two levels of socio-spatial segregation, a fine-grain level within the city centre (due to compensations provided by infrastructure, property taxation and urban form) and conspicuous levels of socio-segregation between city centre and periphery (due to lack of sufficient links between settlements located on the periphery and between the latter and the city centre).

During the 1990s, management was seen as a powerful tool in enhancing upgrade action achievements. The involvement of inhabitants in decision-making, and their close contact with local government technicians and researchers, have been handy tools to overcome spatial limitations imposed by settlements' physical constraints (e.g.: a site's vulnerability to floods and landslides) (Hereda & Alonso, 1996). But to concentrate efforts on the upgrade of existing informal settlements without investigating new solutions and alternatives should be considered as walking ahead while looking backwards (IPPUR/UFRJ/FASE, 2001).

Brazil has recognised the basic right to housing (Constitutional Amendment 26/2000), and the social function of the city (art. 182 of the Federal Constitution/1988 and City Statute/2001), and needs to face a housing deficit which is enormous among the low income population all over the country. As an illustration of these figures, the Fundação João Pinheiro (quoted in Vasconcelos & Cândido Jr,1996:13), estimated a housing deficit in Brazil of 5.6 million units in 1995; in the same article another study by Prado and Pellin (1993) informed us that half of the Brazilian housing deficit corresponded to existing units not served by infrastructure, and mentioned that three quarters of the urban deficit affected families whose monthly income was lower than U$ 260.00 (ibid., quoted in Vasconcelos & Cândido Jr,1996:10). In such a context it is advisable to learn how to build spaces

that do not trap people in poverty, and if possible, to learn how to build spaces that can help people to overcome poverty.

According to research developed by Belém municipality to qualify the city for funding from a program supported by the Brazilian government and the Inter-American Bank of Development (PEMAS, 2001), Belém had a population of 1,279,861 inhabitants in 2000 (corresponding to 71.3% of the Belém Metropolitan Area's population) and a housing deficit of 128,312 units. Fifty-five percent of this deficit corresponds to the detected need for new houses, and 45% corresponds to need for replacement (or upgrade) of existing houses. Settlements were classified as abnormal housing always where either they do not have tenure ownership, or are not in conformity with local land use and occupation standards, or have vulnerable safety conditions or have unacceptable standards according to health requirements (IPPUR/UFRJ/FASE, 2001: 28-29).

Circumstances of squatter settlements differ from region to region, depending on geographic and cultural differences, and the mix between physical and socio-economic conditions in Belém has produced one of the worst expressions of poverty in the country (Valença, 2001). The process of squatting in Belém is similar to what happens in other cities (regardless of their size) in the region which have any prominence in relation to their hinterlands. These include Manaus, with more than one million inhabitants, and Tucuruí, with 80,000 inhabitants (Browder & Godfrey, 1997:123-159; the author's observations in loci, in 1997 and 1998). Low income people occupy waterlogged areas, forming settlements with increasing densities and insufficient solutions to social and physical infrastructure needs.

Considering the extension of Brazilian Amazon territory, the expected maintenance of present regional prospects, and the scarcity of means to give assistance to municipalities, the exploratory investigations into patterns of production of informal space in Belém, carried out in this research, should be of interest to regional and local agendas related to the housing problem in the Brazilian Amazonian region. The information provided can be used in the definition of policies and programmes committed to the improvement of informal settlements in such a way as to provide dignity to the poor and to the city. It would then not be ashamed of its informally produced areas, but would have in them an asset to shelter the poorest and to improve their life chances.

1.4. The research questions

Discussions about the concept of life chances and of what it means to be poor today are introduced in Chapter 2 to set a theoretical framework for spatial investigation, followed throughout the whole thesis. Chapter 3 introduces the context of the developing country city and particularly of Belém. Chapter 4 discusses measurement techniques to assess the spatial dimension of the constitutive elements of life chances - entitlements, provision and ligatures. These three chapters provide the background to the main question of this research, and to the three research questions into which the former was subdivided, as presented below:

Main question: What is the contribution of space to the life chances of invaded areas' low income inhabitants?

1) To what extent do life chances in invaded areas depend on: a) location, b) timescale, c) configuration?

2) To what extent do inhabitants' perception and achievement of life chances vary according to the place where they live?

3) Are life chances improved, and if so to what extent, by the action of government and other agents on the physical configuration of invasion areas?

These questions are posed to allow a richer definition and understanding of informal settlements' spatial dimension. Three variables were included in the first research question: location accounting for distance, timescale to take account of impacts of city development/growth, and configuration to include the internal arrangement of space, to grasp the process of informal settlements' integration into the city and to overcome the limitation of traditional spatial analysis based only on location (see definitions in the Section 1.6). The second research question searches for the inhabitants' understanding of this process and for further evidence about their achievements in terms of life chances. The third research question expands the context and investigates the action of other agents in the space in question.

The research design is presented in Chapter 5, and follows the theoretical framework presented in Chapter 2, related to the understanding of the meaning of life chances and poverty, and in Chapter 4, related to the spatial approaches used to fill out the theoretical framework and to make it spatially measurable. This is highly empirical research, which has used space as a main source of evidence, followed by inhabitants' responses gathered in questionnaires and interviews. Secondary sources

were used to assess the role of other agents in the process, as well as interviews with professionals involved in official upgrade actions carried out in the case study areas.

To answer the first question, Chapter 6 shows evidence gathered from case study areas with different locations, times of origin, and present stage of consolidation. Particular analyses were carried out to assess existing levels of entitlement, provision and ligatures provided by space in each case study area. The street layout's potential for accessibility, assessed through syntactic measurements, was associated with inhabitants' access to income and education in order to find where this potential was best realised, considering the influence of variables such as household size and time of arrival. The syntactic measurements were also checked against other morphological analysis, through variables such as the street hierarchy informally created, street physical conditions (width and infrastructure) and density levels, to characterise provision conditions. Finally the use inhabitants make of space is presented, to provide a better understanding of how much inhabitants use public space to compensate for provision and entitlement constraints.

To answer the second question, Chapter 7 first presents the socio-economic profile of case study areas, giving a short socio-economic profile of Belém as reference. Then access to income and education are detailed as observed in each case study area to assess the achievement of entitlements. Provision is discussed through the conditions of access to housing and the perceptions of change in streets and plots, and ligatures are investigated through the stated trade-offs, motivations and extension of networks in each case study area's households.

To answer the third question, Chapter 8 investigates how the delivery of housing-related laws and policies by the government has affected entitlement in case study areas; how actions in housing production, tenure regularisation and upgrade were translated into provision in case study areas, and what were the current paradigms present in plans, laws and policies which had affected these areas. The agents taking part in the process were then identified, and their participation in the process was graded according to the power they had to affect physical configurations.

1.5. The research approach

Investigations into low income housing demands carried out by Brazilian official agencies are usually concerned with economic perspectives, despite the urban nature of the housing issue. They are related primarily to a macroeconomic scale of observation, perhaps due to the country's size and the need to make comparisons between different regions in order to define national policies to tackle the problem (Santos,1999). Conversely, Brazil has a tradition of town planning, inspired by Haussmann's works in Paris, directed to sanitation and beautification of the city, often detached

from the process that had originated the unpleasant conditions now to be modified through public intervention (Villaça, 1999; Hardoy, 1993). This was especially common during the first half of the 20th century, and still has influence on procedures of official funding agencies that encourage macro-drainage work and high standard engineering solutions for sites inhabited by people who had no choice but squatting.

Architectural practice has also followed official trends; architects at first were greatly concerned with qualitatively acceptable solutions; by the 1960s they had changed attitude, searching for more substantial knowledge from social sciences to understand why good architecture by itself could not provide for housing demands. Advanced urban studies were easily approached through the lenses of urban and regional planning during the 1970s. By the mid 1980s, reactions to spatial neglect were registered in the pioneering combined research of architects and anthropologists (Santos & Vogel, 1981), which investigated the relationship of inhabitants to public space in a traditional district, doomed to eradication, and in a new development in Rio de Janeiro. At the same time, Carlos Nelson dos Santos, in his introduction to the Second Seminar of Urban Design Proceedings, called upon architects to act as architects rather than as sociologists, economists, transport engineers, etc. (Santos, 1984). This was also the time of the putting together of the first Brazilian research program on urban design by a group of lecturers in the Institute of Architecture of the University of Brasilia, who advocated the establishment of architecture as a research field (Turkienicz *et al*., 1986).

The latter approach was reflective, located between the everyday spatial practice of architects and the discussion, detached from space, of planners and social scientists. Turkienicz ***et al.'s*** aim was to make explicit the different functions of architecture, indicating sub-disciplines originated through the relationship of human needs and space that should be researched in the light of ecology, ethics, and the aesthetic of the object of analysis. [2]

My contact with the methodological structure of this research as a post graduate student gave me a remarkable opportunity to explore morphological research, due to the richness of analytical tools it made available. However, once back in Belém's context, the author was introduced to urgent demands for practical application of spatial knowledge. These ranged from the concern of official offices with preservation of historical urban form to the requirement for consistent tools to support local regulations to control spatial production and reproduction of the city. Within this range, the particular problem of the former waterlogged areas' upgrade was most striking, due to these areas'

[2] Holanda (1997) describes the concept of the research, using a text of Hillier and Leman (1974) as his starting point. He introduces the idea of seven functions in architecture: functional, co-presence, bio-climatic, economic, topoceptive, emotional and symbolic. Each of them should be sub-divided to allow the evaluation of the functions in different contexts: ecological, ethical and esthetical (Holanda, 1997:20-21).

outstanding capacity to present alternative spatial solutions to their inhabitants' socio-economic constraints.

Drawing from the presented facts and previous experiences, this research takes a case study approach, which provides opportunity for morphological investigation into the specific socio-economic context of informality and urban poverty. This shifts the conventional focus of urban form evaluation standards from general human needs or expectations to basic human needs. This position corresponds to an attempt to take a place in the middle ground between the a-spatial Marxist oriented urban researches, and the beautifying and sanitary approaches detached from the processes that originated their object of interest. It benefits from the tools of analyses made available by different schools of urban morphology.

The case study areas are divided in two main locations: within the city centre and on the periphery, chosen from the city's densest areas and the area which presents the highest levels of growth in the city respectively (PEMAS, 2001). Case study areas are also differentiated by their stage of consolidation and original tenure conditions. In each area spatial data was gathered having the household as the basic unit, and socio-economic data took individuals as units. This provided information to analyse the internal arrangements in the household that could be important to explain spatial achievements.

1.6. Definitions

This research uses five key concepts. They are life chances, poverty, informal settlement, urban form and consolidation.

Life chances, as presented in section 1.1, are the long-term prospects of someone brought about by choices from available options and according to a person's social objectives. It expresses a multidimensional theoretical concept, subdivided into three elements – *entitlement*, the lawful means of access or rights of access; *provision*, the material options or choices among goods and services; and *ligatures*, provided by traditional social ties and institutions such as family, localities, religions, parties, social classes, which give meaning to choice. In practical terms ligatures are translated into access to information through social networks and practised values that justify one's trade-offs (Dahrendorf, 1979,1988).

Poverty is understood not only as the state of being poor, or of living below the poverty line - an official level of income that is necessary to be able to buy the basic things one needs, such as food and clothes and to pay for somewhere to live (Asbhy, 2000 – Oxford Advanced Learners Dictionary). This economic-based definition is unable to explain how people survive while living

below the poverty line, and has been replaced by definitions that receive contributions from the poor themselves. The best definition of poverty for this thesis is that of poverty as lack of life chances (Kempen, 1994). According to that, the poor are those who are prevented from accessing, among other basic resources, education and health care, remunerated work, housing and a safe environment, and who have been split from their social networks.

Informal settlements are any irregular settlement with an unconventional form of housing production and/or irregular tenure and physical conditions. This definition is drawn from the definition of informal as something not done or made according to a recognised form; irregular, unofficial, and unconventional, given by the New Shorter Oxford Dictionary. The same dictionary defines settlement, among other definitions, as a community settled in a new country, a colonised tract or country; a colony, especially in an early stage. Also, a small village or collection of houses, especially in a remote or outlying district. Informal settlements are called squatter areas, shantytowns, invasions, pirate or clandestine settlements, slums, etc. depending on the nature of irregularity or form of occupation. During the 1970s these settlements' physical deprivation was extended to their inhabitants' way of life; the latter were often seen as people with low levels of education, informal jobs, socially disorganised. In sum they were seen as marginal to society (Kowarick, 1975:14). This myth originated the physical-ecological approach that advocated the material eradication of informal settlements through official programs of low income housing provision. This was scarcely ever achieved, since government provision was always far below social demand and above what the poor could afford (Valladares, 1982). This reinforced the alternative approach to removal: the urbanisation or upgrade of informal settlements, which became an object of international funding, and of national policies in Brazil during the late 1990s.

Urban form is the built space or configuration of cities constituted by the site, the constructed space (buildings), the open spaces, plots and streets. These physical elements can be observed at several scales of interface, such as building/plot, street/block, district/city. Physical elements express cycles of change through their continuous transformation, determined by cultural and socio-economic circumstances of social groups that are producing them, according to intrinsic laws that urban morphology tries to identify (Moudon, 1997; Levy, 1999). In this research, the relationships most investigated are those related to streets, because they are the longer-lasting element of urban occupation, with strong physical and social importance, to the extent that they provide access to plots and define block subdivisions and are the main aggregators of private and public investments (McGlynn, tutorial 2002a). They also work as a link to the different approaches of analyses used to assess the distinct constitutive elements of life chances. *Entitlements* are measured through space syntax techniques, due to the capacity of the latter to associate the extrinsic properties (topological relations between spaces of a system, position of visual fields,

properties of connection) of configurations with potential for movement (Hillier & Hanson, 1998). The quantitative findings obtained through space syntax also made possible cross-tabulations with data produced according to Cannigia's & Maffei's (1995) evolutionary approach, accounting for *provision*. That allows the study of the street layout as a development of previous structures deeply rooted in local traditions (Marzot, 1998), and as a system constituted by the space and by its infrastructure counterpart (Cannigia & Maffei, 1995); this, owing to the informal settlements' origin is hardly ever present. The relationship of inhabitants to the space of streets is explored as *ligatures*, when evidence of inhabitants' habits, solidarities, constraints and social values is searched for.

Consolidation is defined in the New Shorter Oxford Dictionary as the action or act of uniting or amalgamating; combination into a single whole; whereas stage is defined, among other meanings, as a period of time, an appointed date; division of a journey or process. Thus the **consolidation stage** is a period in a process of gradual integration of an informal settlement into the city, usually transformed into a low income district or suburb (it follows the urban morphology rationale of evolution of urban forms through stages of development), where houses are improved, and community and political pressure on local agencies result in provision of physical (water, power, drainage) and social (transport, schools, health centres) infrastructure (Gilbert & Guggler, 2000). But where also there is increase in density levels and worsening of health conditions when infrastructure is not synchronously provided. In this thesis the **process of consolidation** is understood as arising from an association between location, configuration and timescale, and is investigated in order to assess its effects on inhabitants' life chances. Location expresses the possibilities found by inhabitants of overcoming distance, given by socio-spatial characteristics of the city. Configuration shows the physical arrangements between spatial elements in a given moment, it is considered as a static snapshot of a process of change which occurs over time, through upgrade actions practised by inhabitants and other agents. Timescale introduces the time dimension that allows observation of the successive configurations developed over a process of consolidation and of changes in the relationship between space and agents who are producers of space (McGlynn, tutorial 2002b).

1.7. The structure of the thesis

As already presented in Section 1.4, the thesis is divided into nine chapters. The first chapter introduces the purpose, central problems of the research and its aims. The selection of the research approach is justified, the key concepts are presented and a summary of methods outlined.

Chapter 2 consists of a discussion of the meaning of life chances and contemporary poverty, and of correspondences between the two concepts in a developing country context.

Chapter 3 focuses on the reality of the developing country city, discussing its main characteristics in terms of social and spatial inequality. It introduces the issue of informality and the usual approaches adopted to tackle informal settlements' deficiencies. It discusses general aspects of the problem in Brazil and introduces the particular context of Belém.

Chapter 4 introduces the spatial dimension of life chances. It also articulates the relationship of the former conceptual framework to spatial techniques and morphological approaches of analysis that might be applicable to informal settlement spatial analysis. Entitlements are associated with accessibility conditions, provision is associated with the urban form's evolution patterns, infrastructure conditions and density, addressing environmental concerns. Ligatures are associated with social and physical distance, and the poor's trade-offs of social interaction against physical provision.

Chapter 5 presents the empirical research design, reminds the reader of research questions and aims, introduces the case study areas, and presents methods used to gather and analyse data.

Chapter 6 provides evidence to answer the first research question through giving the results of spatial analyses and cross-tabulation between spatial and selected socio-economic variables. All results are presented per case study area to allow comparative conclusions (which take into account their different stages of consolidation and differences in configuration).

Chapter 7 provides evidence to answer the second research question. It briefly presents Belém's general life standards as a background to the case study areas' socio-economic profile. Then the results of questionnaires and interviews with inhabitants are presented, to assess differences in the perception of achievement of entitlements, provisions and ligatures in each case study area.

Chapter 8 addresses the third research question. The delivery of entitlements, provision and the practised paradigms of action are presented, focusing especially on governmental capacity to act on behalf of other agents' interests. The agents and their position in relation to the urban form production are presented.

Chapter 9 presents conclusions to the research findings, draws the results of research questions together to answer the main research question, identifies limitations of this research, directions for further studies and the contributions to knowledge made by it.

Chapter 2
Definition of Life Chances and Modern Poverty

Chapter 2 Definitions of life chances and modern poverty

2.1 Introduction

This chapter aims to introduce the concept of life chances as it is used within this research. In order to do this, a further explanation of the constitutive elements of the concept, that is, entitlement, provision and ligature is presented. At the end, a discussion about modern poverty is presented, showing an application of the concept of life chances to create a link between poverty and land invasion problem.

2.2 Developed and developing countries' understandings of life chances – differences and similarities

The understanding of 'life chances' may vary slightly in different contexts, since it depends on local socio-cultural and political conditions as much as on macroeconomic and international agreements about entitlements. The arbitrary division of the world into developed and developing countries is being used here to highlight some important differences. Developed countries, arguably, can be considered to be the 35 market-oriented countries that belong to the Organisation for Economic Co-operation and Development (OECD). This leaves the world's remaining 172 countries to be considered as developing countries. They are the home of 70% of the world's population (Crump and Ellwood, 1998; quoted in Jenks, 2000:4).

In macroeconomic terms, the general development of countries is associated with urbanisation and industrialisation, and the form into which these phenomena have evolved. At present, Soja (2000:11) argues, the developed world has entered a post-Fordist, post-Keynesian, postindustrial, postmodern era, after experiencing mass production, mass consumption, mass urbanisation, social welfare and the effect of labour union actions. From the developed countries' point of view, this means the conclusion of a phase of rapid growth, and a present characterisation marked by low rates of natural increase, high levels of urbanisation and low population growth rates, but also by dramatic increases in demand for land, energy, food and fresh water, and, conversely, increases in the detritus of waste and pollutants (Burgess, 2000: 12). In terms of life chances, these countries display a strong concern with the entitlement dimension of in order to open up and spread out more choices for all.

Developing countries have undergone a belated and frantic industrialisation during the second half of the 20th century, within the perspective of a fivefold growth of urban population in a fifty year period: from 809 million in 1975 to a projected 4 billion in 2025 (ibid.). This process is likely to

exhibit a much more diverse range of characteristics, due to specific cultural and physical differences between Asian, African and Latin American environments, but they have in common the dominance of the informal sector, strong inequalities and social segregation, great reliance on self-help housing (Jenks, 2000:4) and a permanent struggle to overcome poverty through enhancement of provision and ligatures.

Besides this developed/developing divide, Burgess *et al.* (1997a) identify four trends of change: continued rapid urbanisation of the world's population (already mentioned); globalisation of economic, social, cultural and political activities; intensification and globalisation of 'environmental crises'; and a changing relationship of the state to civil society, brought about by the rise of neoliberalism as a dominant development paradigm. These trends have reshaped the world's geography (and divided approaches in geography science) over recent years, altered contemporary urban planning, architectural and government practice, have affected the space of all cities (and their inhabitants' lives) of the emerging global system, and especially the space of developing countries' cities.

Considering these trends, Harvey (2000) put forward the concept of uneven geographical development, highlighting the destructiveness of the underlying neoliberal paradigm within these capitalist global trajectories. He claims that through understanding uneven geographical development, the contradictions within these trajectories of globalisation can be fully appreciated. For this author, globalisation has brought about a great deal of self-destruction, devaluation, and bankruptcies, in addition to violence, unemployment, collapse of services, degradation in living standards, and loss of resources and environmental qualities. It has jeopardised political and legal institutions as well as cultural configurations and ways of life on several spatial scales. Conversely, he also exposes globalisation as a US geopolitical project, inside a mentality that used to interpret every struggle for social justice everywhere as a pro- or anti- communist action.

One must not be misled by the 'global' of globalisation to accept general claims to its universality. Globalisation has led us to consider, in terms of political-economic fact, our condition as human beings living on the planet Earth, and at the same time has 'forced us to consider the rules and customs through which we might relate to each other in a global economy where everyone to some degree or other relates to or is dependent upon everyone else' (ibid.84). Facts such as environmental commonality have been superimposed on a world of differences. Yet, through the postmodern lens, these differences are increasingly important, because they expose the violence of the ethnocentric modern attitude towards minorities (of culture, gender, disability, nationality, location, political affiliation and social class).

Harvey (2000:73-94) uses the United Nations Declaration of Human Rights as a key example of this mode of thought; he highlights the underlying bias of the document caused by the moment of its creation, when most values and concepts of what rights were about were related to the North American and Western European perspectives. This, according to his Marxist perspective, also makes the application of these rights vulnerable to the interest paid to them by occasion of their application afterwards.

This context encourages the search for new perspectives on the current conflicts; the use of categories (such as imperialism, colonialism, neocolonialism) to label processes oversimplifies present spatio/ temporal relationships (Harvey, 2000). In this thesis, assessment of the particular problem of informal settlements aims to use a bottom-up approach, searching for a perspective able to take into account individuals' motivations in dealing with a diverse range of complex variables in their every day lives. Investigation of the relationship of space (the material result of social and environmental processes) to inhabitants' life chances hopes to shed a new light on an old problem by incorporating values, time-, place- and culture- orientation into the investigation. The following sections explain how this relationship was built as a fine grain sieve to reach particularities of the invasion process in Belém that are not visible through other conventional approaches.

2.3. Development of the concept of life chances

2.3.1. The concept

The concept of life chances has been developed by Dahrendorf (1979,1988) and other authors such as Kempen (1994). It has its foundations in the philosophy, social science and history fields; it incorporates reflection about actions, potential for change and historical evolution, most welcome to the investigation of the problem of informal settlement central to this research. The first Dahrendorf (1979) definition of life chances related the concept to individual freedom and social objectives, which include the achievement of human development and individual responsibility. In a later work, Dahrendorf (1988) explained that this first definition focused on a world of numerous choices but little meaning (choices are not linked in a sensible way), and clearly related to modern concepts in evidence up to that moment. As presented in 1979, it was clearly a West European concept, because of the quantity of basic guarantees it took for granted, such as guarantee of satisfaction of basic needs and the existence of alternatives which can enhance this satisfaction for an individual. Life chances were first presented as dependent on chances offered, plus what Dahrendorf termed ligatures. Ligatures are provided by traditional social ties and institutions such as family, localities, parties, religions, universities and social classes, which give meaning to the options and choices one can have or believe in.

Dahrendorf (1988) defined life chances as available options, options which are expressed both in their entitlement and provision dimensions. The author recognised that life chances are never distributed equally, since there is no known society in which all people have the same entitlements and enjoy the same provision. In this later work he considers the operational dimension and applicability of the concept of life chances, focusing on modern social conflict. The origin of social conflict is in unbalanced structures of power, and, therefore, unequal distribution of life chances.

> Those at the disadvantaged end demand from those in positions of advantage more entitlements [rights of access] and provisions [choices among goods and services]. The struggle, first latent and barely visible, then open and fully organised, leads to a wider spread of both. But it has above all one effect which describes the history of modern societies from the eighteenth century to the present: it transforms differences in entitlements into differences in provisions. From qualitative inequalities we move progressively to quantitative inequalities. Status barriers give way to degrees of status (Dahrendorf,1988:29).

In a study entitled 'The Dual City and the Poor: Social Polarisation, Social Segregation and Life Chances', Kempen (1994) uses the concept of life chances to clarify the role of spatial concentration of poverty. The author, in her case study, associated the constitutive elements of Dahrendorf's concepts with components of the observed processes to measure the delivered amount of life chances. The urban fabric was taken as the provision component related to physical localities; eligibility criteria as the entitlement component related to entitlement to social benefits; and availability of information as the linkage component related to access to knowledge. She considers social contacts and local networks as instrumental aspects of the ligatures component, reinforcing the aspect of belonging. Her research is concerned with how far pockets of poverty affect: conventional models of social behaviour, educational aspirations for children, future chances in the labour market, information (which can be limited by lack of social contacts), jobs within the formal market, fair price, quality and amount of goods and services supplied, efficient public services, and loans.

2.3.2. The constitutive elements of life chances

Dahrendorf (1988) offers further understanding of the relationship between entitlements and provision. Despite social scientists' push towards giving bigger importance to entitlements and economists' push towards recognition of the importance of provision, Dahrendorf shows that one without the other would generate paradoxes of either eligibility without choice or choices without eligibility. Those who emphasise provision believe that the movement of boundaries of scarcity, by increasing the quantity of goods and services, is part of a positive struggle for progress. Those who emphasise entitlements instead recognise the price that some have to pay for the gains of others.

2.3.2.1. Entitlements

Entitlements are themselves neither good nor bad; they are a socially defined means of access. They might be called 'entry tickets' (Dahrendorf, 1988.:11). They are a qualitative, legal and political concept. Entitlements offer opportunities through providing desired access to desired goals, e.g. income and education are not purposes in themselves; they are a means to pursue other goals. They arise from basic rights, including constitutionally guaranteed rights associated with membership of a society, and access to the market. They direct us to what should be the basic and general right of a person, that of being a citizen. Citizenship exemplifies how entitlements do not grow or decline, but are either established or removed, even though always with some cost. They open benefits to those who have them and create barriers against those who do not have them.

The inherent rights of citizenship, as political constitutional guarantees, are taken here as guidance to how things should be, since in developing countries such as Brazil these rights have been officially stated and accepted only in the last decades. From the entitlement point of view, citizenship is the first step towards political rights, and to other means to overcome poverty. For instance, through the condition of citizenship, people may have access to education. Education is expected to promote gain of knowledge about how to take advantage of rights, and about skills required to access income. In its turn, income allows the meeting of basic needs, but also allows people to meet the costs that rights may imply (such as to further education and to legal justice) (Dahrendorf, 1988; Rakodi, 1995a; Moser, 1998).

Citizenship

The concept of citizenship arises from the relationship between the individual, the community (a group whose members share specific characteristics – place, interest, or, in the political sense, a system of governance), civil society (the aggregate of groups of individual citizens organised separately from the state), and the state (Prior *et al.*, 1995:1). These relationships put emphasis on rights, duties and obligations which allow (according to their proportion) the definition of citizenship as a status, as a practice, and as a set of rights (Prior *et al.*, 1995; Hill, 1994).

As a status, citizenship is based on the relationship between people individually and the community's government institutions, and between individuals themselves. The status of citizen establishes reciprocal rights and obligations between citizens and official institutions. As a practice, citizenship is expressed through roles people perform and the reasons why they perform them. This practice can be either active or passive, depending on the way in which rights are defined in a given society, and on how strong and centralised the government is (Prior *et al.*, 1995:5-21).

A strong and centralised state can over-protect its citizens, preventing them from achieving individual needs and aspirations, meanwhile excluding them from the decision-making process, and not allowing them to influence public services. Conversely, a very reduced state expects only to provide a minimum protection in order to maintain individual freedom; the practice of citizenship is then reduced to the practice of the consumer. The citizen has separate identities according to the role performed and the context, as, for example, a patient, or a parent, or a passenger (ibid.).

The status of citizenship gives social entitlement to the achievement of better life chances, realised through practical citizenship, in which one finds networks which link together the choices people make. The authors of the political left suggest emphasis on participation in the process of decision-making, rather than achievement of targets, as an alternative to conservative and neoliberal traditions (Prior *et al.*, 1995:16). Prior's argument is that through the dynamic relationship between the individual, state and civil society, the generation of a constructive practice of citizenship is more likely to occur than through the privilege of the rights of individual consumers.

Citizenship has been defined by Western societies throughout the last three centuries as a set of rights. In the 17th and 18th centuries, legal or civil rights enabled citizens to participate in the life of the community, making contracts, expressing themselves in words or print, having religious freedom, and so on, according to the prevailing law. During the 19th and early 20th centuries, political rights allowed people to participate in government through representative democratic systems. The 20th century witnessed the turn of social rights, created to enable people to receive benefits in order to meet the general standard of well-being established in the community. This was a reaction to the inequality produced by the market economy (Prior *et al.*, 1995; Hill, 1994).

In addition to these concepts, there are ideological concepts of citizenship. The liberal democratic position regards the inclusion of social rights as meaning a restriction on individual liberty, to the extent that people must pay taxes in order to finance the whole community. Social democrats consider 'social and economic rights essential to securing some degree of equality in the wellbeing and life-chances of citizens' (Prior *et al.*, 1995:9). Although both concepts incorporate views on individual obligations, the first is over-concerned with liberty, and the second focuses on rights rather than duties. Meanwhile Marxists claim that all concepts of rights are captive to bourgeois institutions and that to take them as a foundation of any politics is pure reformism (Harvey, 2000:86).

Ecologists are concerned about the relationship between people and the global environment, and argue for a new kind of right, the individual's right to be protected from the effects of environmental pollution and exploitation, in order to 'safeguard the environment itself for present and future

generations' (Prior *et al.*, 1995:10). Feminists argue for a new kind of right as well. They want equality in domestic life (such as shared parental responsibility for children): whereas historically men have been concerned with liberty from the state in order to live free of interference, women have needed state support to be free of domestic tyrannies (Prior *et al.*, 1995:11; Hill, 1994:75).

Through these concepts of rights arises a concept of citizenship which goes beyond status. This means that if, for example, the welfare state is a contemporary outcome of the sense of citizenship, and welfare is a duty of the state, there is a duty of citizens to their community (duty of paying taxes, of being educated, etc.). This relationship expresses the true virtue of civil society – civility, not as courtesy, but as a common good. Civility is also a condition for plurality, allowing respect among members of the same society, even if they have opposing views (Hill, 1994:19).

The development of the concept of citizenship shows that since the idea of civil society has been established, a great deal of inequality and domination have risen alongside it, always because concepts were defined according to the values and interests of powerful elites. Fortunately this trend has been challenged by the recent search for empowerment of minorities. According to Marshall (1950:quoted in Prior *et al.*, 1995:7), citizenship must be understood as a historically variable concept that does not suggest inherent rights and obligations, because these elements are always subject to changes produced by historical development.

In the case studies presented in this thesis, inhabitants were initially deprived of the status of citizens because the official provision of low income housing was inadequate and insufficient, and the poor had no way to participate in a consumption-based relationship with the market, unprepared to address their 'individual' needs of income, housing, jobs, and, in short, life chances. Low income people's original deprivation led then to constraints over a wide range of rights and guarantees (e.g.: to a healthy environment, to basic infrastructure, to child care). However, over time these inhabitants acquired awareness of 'political' practices that could help them to overcome their constraints and gradually introduce themselves as citizens within the urban environment, as presented in the empirical chapters of this thesis.

Access to basic rights such as health care and education, taken as part of the basis for a more productive use of labour, is an important outcome of citizenship. These elements (health status and level of education) are the means to human capital achievement, according to the 1990 Poverty World Development Report (World Bank:1990, quoted in Moser,1998:2), a study that focuses on what the poor have as assets rather than on what they do not have. Human capital is one asset of a framework created by the World Bank to assess and reduce poverty; within this research it is

understood to be related to the entitlement dimension of life chances. This idea will be recalled later in this chapter.

2.3.2.2. Provision

'Provision' is a designation for any class of things which are material and vary in quantity or amount and in diversity. Provision means availability of supply and is dependent on economic growth. In this thesis, due to the concern about socio-spatial polarisation, the expression of provision is seen as related to urban infrastructure and housing conditions. Other material needs such as food and clothing will not be considered here.

The discussion about provision of housing and infrastructure opens up a wide range of theoretical and practical approaches to urban processes. The 1920s studies of the relationship between social structures and spatial organisation developed ecological models that gave supremacy to space as a cause of inequality (Basset and Short, 1980). The 1960s Marxist approaches advocated the idea that social processes were universal and spatial patterns were an end product of social relations (Burton, 1997: 64). The 1970s and 1980s approaches of geography and sociology reintroduced the discussion of space into the urban debate, looking for a middle ground between the previous approaches (Harvey, 1973; Soja, 1980).

Box 2.1. Main Formulations of Social Equity, adapted from Lima (2000: 50-51)

Egalitarianism	Distribution that reduces any existing social or economic inequality among social groups in a community (Dworkin, 1977; cited in Kymlica, 1992:49)
Utilitarianism	Distribution of benefits to the greatest number, regardless of inequality (Bentham, Principles of Morals and Legislation written in 1789; Mill, Essays on Utilitarianism and on Liberty written in 1850)
Equal shares	Distribution of benefits as equal shares (Beatley, 1984)
Communitarianism	Distribution that maximises the common good in the public interest (Sandell, 1982)
Compensatory discrimination	Distribution based on maximisation of benefits to the least-advantaged groups; inequalities are identified to show and then help the worst-off (Rawls, 1972)
Welfare theories	Distribution of benefits based on contribution to state welfare schemes (Beveridge, 1942)
Liberalism	Distribution according to equal opportunities, based on right to compete on the basis of talent to achieve desirable goals (Keynes, 1926)
Marxism	Distribution, based on community justice, to alter social structures, by the expropriation of capital owners and removal of causes of inequality (Marx's Capital)

The 1990s raised concern about sustainability, aiming at the efficient use of natural resources in order to safeguard the environment and to avoid resource depletion, and introducing the need for intra-generational and inter-generational equity (Elkin *et al.*, 1991). These two forms of equity generated two agendas: the brown one, concerned about pollution and poverty, and the green one, concerned about environment. In boxes 2.1 and 2.2 the main formulations of equity are shown. Some of them have been particularly addressed to contexts of constraint on choice for disadvantaged groups, as in Brazil and many developing countries. Lima (2000) highlights the

importance of the incorporation of compensatory discrimination to urban policies in Brazilian cities. Authors such as Hardoy *et al.* (1992) and Drakakis-Smith (2000) show the concern of urbanists with sanitary or environmental health in the generation of the brown agenda, as a counterpart to the long-term concerns with sustainability present in the green agenda.

Box 2.2. Principles of the Brown and Green Agendas Applicable to Environmental Problems in Urban Areas, adapted from McGranahan & Satterthwaite, 2000:76

Brown agenda	Green agenda
• *Intragenerational equity ,* rising from inhabitants' needs for healthy and safe living and working environments and the infrastructure and services these require • *Procedural equity*, to ensure respect of the legal right of all people to have a healthy and safe living and working environment, and also fair treatment and the opportunity to engage in decision-making for the management of the city where they live	• *Intergenerational equity*, expressing the hope that urban development does not draw on finite resource bases or degrade ecological systems in ways that compromise the ability of future generations to meet their own needs • *Transfrontier equity*, to prevent urban consumers or producers transferring their environmental costs to other people or other ecosystems, for instance by disposing of wastes in the region around the city • *Interspecies equity*, to ensure the recognition of other species' rights

These theoretical formulations usually influence the problem of informal settlements and insufficient provision of low income housing in developing countries through macroeconomic impositions, expressed in the political and technical orientation of governments and funding agencies to housing provision. The economic structural reasons for the under development problem have not changed up to the present, and the discussion of its causes is outside the scope of this thesis, although a characterisation of its expression in developing country cities is presented in the Chapter 3.

Box 2.3 shows the evolution in the understanding of the informal settlements process, and the urban policies addressed to the problem. The initially oversimplified views led to naïve ethnocentric and excessively restrictive approaches, based on the ecological supremacy of space, and believing that ordered official settlements could be the best solution to the problem (Payne, 1977). The failure of that solution was accompanied by acknowledgement of the problem's complexity; the financial limitations of governments to produce official low income housing according to quantitative demands led to the incorporation of the poors' strategies of housing production and to the creation of programs of informal settlement regularisation. The tenure/ownership issue was then emphasised by the speculative land market context of inflationary developing countries' economies (Burgess et al., 1997b; Payne, 1984).

Box 2.3. Urban policies applied in developing country cities over the last four decades adapted from Burgess *et al. (*1997b, 1997c)

Urbanisation process and theory of development	Urban policy and results
• During the 1960s, developing country cities were at transitional stages within the framework of 'universal' typologies derived from the historical patterns of Western urban development; the adverse aspects of the phenomena should improve through further growth and development, and needed strong regulatory intervention. • The shantytowns built on the urban periphery and 'non-urbanisable' land were seen as the result of the migration of rural peasants to the city. It was believed that migrants reproduced their original values and physical living conditions in these settlements, considered as obstacles to progress towards modernisation.	• In the 1960s urban policies were set up to avoid extension of services and infrastructure to informal settlements; the aim was eradication and replacement of existing housing units by conventional core units, with minimum standards, in official settlements. • Slums and shantytowns proliferated beyond control. The supply of conventional units was minuscule in relation to need, and even with subsidies they were still unaffordable to up to 75% of the population of developing countries.
• The 1970s watched the continuation of the socio-economic mobility of urban residents, through their transition from renting to owner-occupation. A life-cycle of migrants was presented, starting in rented inner city slums and continued in constantly developing squatter settlements, the last point of residence for established migrants. • Public housing policies began to incorporate the successful experiences of self-help and self-management. The extension of public investment, infrastructure and services would allow the expansion of state output and increase the propensity to invest savings, labour and management skills in shelter and urban development.	• The 1970s saw emergence of site and services and self-help housing projects, core housing, slum and squatter settlement upgrading, tenure regularisation programmes, offers of managerial and technical assistance and stimulation of small-scale enterprises and informal sector activities in project areas. • Ownership was encouraged, and so was the sprawl of low density occupation in peripheries through the extension of linear roads and infrastructure. However, over the decade, policies needed to be reviewed, because the proposed solutions were neither affordable by the poor nor could they meet cost recovery or replicability criteria.
• During the 1980s the poor had scant access to resources; then once focus was on public and privatised sector provision, housing also became a macroeconomic tool for activating the economy.	• The 1980s saw creation of 'Integrated development projects', carried out through upgrading slum and squatter settlements, sometimes combined with site and services provision to permit decrease of built density. • The positive achievements of the affordability-cost-recovery-replicability formula decreased, site and services provision and slum upgrading were gradually stopped, while exclusive attention was paid to squatter settlement upgrading. These policies were insufficient to improve urban shelter and solve services problems.

• The 1990s unveiled a time of profound technological, social, economic and political change. To satisfy neoliberal demands, drastic measures were undertaken within cities to meet cost recovery and replicability criteria, translated into managerial and institutional reforms rather than into material and technical approaches. • The rise of the theory of enablement and its practice has been the outcome: in order to overcome debts, the public sector has withdrawn from productive fields to assume a regulatory role, and created strategies and conditions to empower the informal sector, leaving local levels of management and the community to manage their interests among themselves and with the public sector.	• In the 1990s state withdrawal and privatisation, elimination of subsidies, deregulation, political-administrative decentralisation, and increased participation of occupants, were among other changes. Urban planning lost space and territory as dimensions of housing policies. Housing became an economic concept, a sum of goods and services, rather than a spatial structure to support these services. • Housing policies were defined through measures to enable different sectors to materialise the process. In practice much less attention was paid to community enablement than to market enablement, and despite the belief that this is a fair solution for all, the natural conflicts between these agents are far from resolved.

The further changes in the world economy towards globalisation and the shrinking of governments led to the failure of all the recipes and expectations based on official action to meet demands for low income housing in developing countries (Payne, 1999). Besides, the neoliberal assumption of a self-regulated market transformed housing into an economic concept, detached from its spatial dimension (Burguess *et al*., 1997b). In developing country economies, where the market is regulated by scarcity conditions, the absence of correspondence between housing policies and upgrade of informal settlements inserted new regularised areas into a deprived housing market. This prompted the outbidding of the poor by better-off economic groups and the intensification of the invasion problem as a strategy by the poor to profit from the land market, at the expense of the environment; sites unsuitable for urban occupation were those best suited to informal occupation (Payne, 1984; Hall, 1987; Hardoy,1989).

Housing provision in developing countries has proved to be an increasingly complex issue (in social, economic and environmental terms), when seen from the perspective of governments and better-off groups. From the perspective of the poor, housing was recognised in the 1990 Poverty World Development Report (World Bank, 1990, quoted in Moser,1998:4) as a productive asset that cushions households against severe poverty (Moser, 1998:10) by facilitating strategies such as densification of plots for additional household members and launching home-based enterprises.

This research adopts the latter perspective to investigate the invasion process in Belém, where informal settlements happen in diverse conditions and, thanks to an absence of control and of effective housing policies, consolidate over time, independently of regularisation of tenure ownership. This created the research interest of this thesis in the spatial solutions practised in these areas, and in their relationship with inhabitants' purposes, motivations, values, etc., presented next.

2.3.2.3. Ligatures

The meaning of ligatures stems from the understanding that there must be something else between entitlements and provision, since the former does not lead to the latter and vice versa (the opening up of a previous authoritarian system does not lead to economic growth, nor does economic growth necessarily lead to equality). Other components of life chances have to be considered: human motivation, guided by traditional, social, cultural, political and other kinds of link.

From an unconventional economic perspective, Sen (2001:3) claims that individual freedom is a social product and that freedom and human agency are the means to the development of developing countries; moreover, in that context, freedom should be considered an overarching objective of development. Free human beings, through rationality, can equate and practice trade-offs between an immediate but shorter pleasure and a bigger, but slower, achievement, according to their constraints and freedoms (Dahendorf, 1988; Condorcet, 1968, cited in Sen, 2001: 214, 216). This capacity is improved with education, good health and political awareness (Sen, 2001). From the life chances perspective, these attitudes are also related to philosophical and ethical positions, because of life chances' intrinsic undertone of liberty: the choice would be given to everyone either to be integrated into society or to renounce it, and for those living as hermits, the choice of withdrawing from it, if this is their choice (Dahrendorf,1988).

MacCallum (1977, quoted in Gray, 1991:3) presents a value-free concept of freedom, described by the formula 'X is free from Y to do or be Z' (X is the agent, Y is the obstacle and Z is the objective), which helps the differentiation between social and individual freedoms. Social freedom is addressed through the question 'in what circumstances is someone free?', and individual freedom through the question 'what is it like to be a free person?'

Social freedom depends on the degree of impediments, availability of choices, and access to effective power and status. Of the first, Gray's (1991:19-30) interpretation claims that physical, cultural and legal constraints are a prerequisite of freedom, that it would be impossible to live in a world without impediments. These are understood as the results of actions, of either omission or commission, expressed through laws, threats or physical impediments. Of the second Gray's (1991:31-44) interpretation is more suitable for use in consumerism matters, if focused on choices. It highlights the cultural relativity of the concept of freedom, pointing out that standards and expectations may vary from society to society. The degree of freedom depends on the range of meaningful choices, taking into account the cost they may imply and therefore their feasibility. Of the third, Gray's (1991:41-46) interpretation focuses on the capacity of a person actually to exercise choice, by taking part in decision-making processes, for example. This is concerned with contexts of inequality and the achievement of freedom rather than the potential for freedom. Of the fourth,

Gray's (1991:46-52) interpretation defines freedom more institutionally, stressing what a person is, more than what he/she does. For some authors, freedom is confined to the political sphere, and related to active citizenship as a solution to colonialism and against threats such as totalitarianism and disillusionment.

From the individual's point of view, freedom is related to self-determination, realisation of will and self-mastery. As self-determination, it demands personal understanding of what it is to be independent within the process of socialisation, and recognises limitations to free action caused by heredity and environment, and also asserts that agents contribute to the processes which determine their actions. The realisation of will involves discussions of paternalism; it is a mental concept of freedom and lies in one doing those things that one wants which are within the bounds of practicability. It connects desire with wants and, rather than assessing degrees of freedom, considers how much our various freedoms and 'unfreedoms' (constraints) matter to us. Freedom as self-mastery is composed of moral virtue (the idea of a person overcoming the evil impulses in his/her nature), personal development (to make the best of oneself), intellectual rationality (to act in a purposeful, deliberate, reflective and disciplined fashion), and mental stability (the free person is psychologically secure) (Gray, 1991:52-81). It focuses on the process of psychological struggle between the liberating and the enslaving elements within the agent's character and is the interpretation most concentrated in the personality of the agent (Maritan,1972, quoted in Gray,1991:73).

The different types of freedom complement each other, and imply economic, political and social freedoms, either delivered or constrained by society, which build up cultural and psychological freedoms of individuals. When strong institutions allow social security, social commitment allows access to health and education, and therefore to income; individual and public wealth strengthens social institutions; decision-making is based on good information, among other things. There is social justice through free choice (Sen, 2001).

Social groups are able to cushion themselves against institutional omission and socio-economic exclusion from mainstream society, as is the case of land invasion inhabitants. Moser (1998) highlights the long time since anthropologists acknowledged the importance of intangible assets, named by economists as social capital. Social capital is defined in the 1990 Poverty World Development Report as 'reciprocity within communities and between households, based on trust deriving from social ties' (World Bank, 1990, quoted in Moser, 1998:4). Other authors define 'stocks' of social capital 'as the informal and organised reciprocal networks of trust and norms embedded in the social organisation of communities – with social institutions both hierarchical and horizontal in structure' (Putnam, 1993; quoted in Moser,1998:4).

The social unfreedoms of squatter settlement inhabitants led them to look for choices through informality. Since they cannot rely on formal laws and official social assistance, they live according to their own system of values and codes (Hardoy & Satterthwaite, 1987, Hall & Pffeifer, 2000). Despite poor people being blamed for having a short-term view, they show a long-term view in their attitudes, accepting sacrifice in order to own a house or to educate children for instance; given the difference of means, the entrepreneur or multinational company who pollutes the environment has a far shorter-term view than they do (Chambers,1995).

The poor survive by performing several different activities; they build their livelihood through casual labour, mutual help, contract outwork, domestic service, craft work, transporting, and begging, among other activities; household composition is determinant of how this livelihood is formed, of how priorities are established and of how decisions are taken (Chambers,1995)**.** Household composition reflects inequalities in levels of vulnerability and deprivation among their constituents. A household's profile may indicate which values and motivations have guided the choice of a certain location in which to settle rather than in another, and of specific spatial requirements and typologies, completing the overview of how space contributes to life chances' enhancement.

Based on their individual freedom, they have created a socio-spatial environment responsive to their needs, exposing their values and needs, willingness to make trade-offs, and in some cases their capacity to foresee the importance of access to education in their lives. Despite the threats to health, and the unbalanced relationship with politicians and local authorities, they have managed to take part in the urban life, and demonstrate the power of the combination of will and social assets, as the empirical chapters of this thesis show.

2.4. Definition of poverty, using the concept of life chances

2.4.1. The classical definition of poverty

The last decades of economic structural adjustment in developing countries have resulted in concentration of poverty in urban settlements (Wratten, 1995:11). This has shifted the conventional pre-1980's discussion about poverty within developing countries from rural to urban environments. Poverty has been often defined in economic terms, through income and other standardised social indicators, to allow comparisons between different places and over time by international agencies and national governments (Wratten, 1995; Moser, 1998, 1995; Rakodi, 1995a; Chambers, 1995). However, income-defined poverty is not a useful indicator when ability to access is considered, because access may be influenced by factors such as education, information, legal rights, health condition, violence and insecurity. Neither does income-defined poverty take into account

economies of scale which benefit large households (Wratten,1995:13; Moser,1998:11; Pahl,1988, quoted in Kempen,1994:999), nor home production or self-employment (the latter are recognised as important income sources for the urban poor) (Wratten,1995:13).

Therefore, to understand how poor people survive while sometimes living below internationally established lines of poverty and extreme poverty, evidence from anthropological studies has been considered. These studies have shown that people's understanding of disadvantage differs from that of 'professionals' (Wratten, 1995:15), highlighting that a great deal of importance is given to qualitative dimensions such as 'independence, security, self–respect, identity, close and non-exploitative relationships, decision-making freedom and legal political rights' (ibid.). This implies that to produce a clear picture of poverty, contributions from the poor themselves are needed.

These preferences might explain the poor's agency in creating informal settlements. Despite such an agency being more a result of official omission than of expression of freedom, the poor have acted and brought about some change and reached achievements that must be evaluated in terms of their own values and objectives (Sen, 2001). For instance, according to Payne (1977), the poor living in informal settlements look for: a) control of housing location, type and costs; b) conditions to minimise their transport expenses and favour their access to income, such as mix of land uses and proximity to other economic groups; and c) favourable prospects of infrastructure provision (p.194). Affordable housing, reaching these aims, is usually traded-off in Latin America and Asia against health. Because of that, many diseases that scarcely occur among the middle or upper class, such as dysentery and infant diarrhoea, schistosomiasis, malaria and tuberculosis, are prevalent among low income people, and cause physical and mental weakness that prevents them from overcoming poverty through labour (Nunan & Satterthwaite, 1999: 6-12).

Beall (1995:429) relates a cycle of environmental improvement through upgrade and enhancement of health conditions in Pakistan, corresponding to the inhabitant's 10 to 15 further years of domestic, informal or waged work. Other acknowledged trade-offs in Asian countries are related to work at home, in cases when the shelter is only possible because of the production to which it gives space and vice-versa, often through superimposition of activities in the same space. In African countries children's schooling is postponed as much as possible, and sometimes sorted out by the child's transfer to the countryside where education is more affordable to low income families than within cities (Rakodi, 1995b:466). In the African context, the presence of women for half the year in the countryside to cultivate their family's food is also a frequent strategy to ensure nutrition (ibid.:458).

2.4.2. The participatory definition of poverty and the concept of vulnerability

Because of the differences cited above, a more subjective approach to poverty has been created, called participatory; it uses multiple subjective indicators to evaluate poverty status (Moser,1998). Participatory investigations are based on entitlements and vulnerability conditions, to clarify the understanding of poverty. Vulnerability is a concept, translated from other fields to urban studies as 'insecurity and sensitivity in the well-being of individuals, households and communities in the face of a changing environment, and implicit in this, their responsiveness and resilience to risks that they face during such negative changes' (Moser,1998:3). Changes can be ecological, economic, social and political and often contribute to increased risk and uncertainty and decline of self-respect.

Table 2.1 shows how, according to Moser (1995), vulnerability is determined at different social levels:

Table 2.1. Determinants and associated indicators of urban vulnerability and well-being by level, according to Moser (1995:167)

Individual	Access to adequate nutrition and health care Access to adequate education Access to adequate income Personal safety from domestic violence Access to credit
Household	Household type Household structure in terms of members in productive, reproductive and community work Stage in life cycle Access to housing
Community	Access to, reliability and quality of, basic needs: water, electricity, sanitation, roads, education and health care Personal safety from robbery and violence Capability and capacity of community-based organisations
Civil Society	Degree of political freedom and political rights

The concept of vulnerability allows an important disaggregation of the experience of poverty, in order to unveil how assets and resources are managed within a household, depending on who is entitled to do or decide what inside the household (i.e. according to age, gender, ethnicity, physical conditions) (Chambers, 1995:189-190; Wratten, 1995:15). It also allows a better understanding of household livelihood strategies, recognising the poor as active agents who respond as well as they can to the circumstances in which they find themselves (Ghafur,1997). Hence, the idea of vulnerability could catch the dynamic of people moving in and out of poverty. Even though neither are all vulnerable people poor, nor are poor people always the most vulnerable, its application may allow a better differentiation among low income populations (Moser, 1998:3).

Moser (1998:3) stresses that low income people should not be seen as helpless victims. They have been recognised as managers of a very complex portfolios of assets, often oversimplified by policy-makers. Those assets have been noted in this chapter, together with the constitutive elements of

life chances. The latter are labour and human capital, here related to entitlements; productive assets related to provision; and household relations and social capital, here related to ligatures. The author claims that the capacity to cope with vulnerability is more dependent on the capacity to manage these assets than on the initial assets themselves, and that in some cases the preservation of these assets is more important than meeting immediate food needs (de Waal, 1989, quoted in Moser, 1998:5).

2.4.3. Poverty as lack of life chances

From what was selected and presented from the vast literature about poverty, it is possible to say that the modern poor are mainly those who lack life chances; i.e. those who are prevented from accessing, among other basic resources, education and health care, remunerated work, housing and a safe environment, and have been split from their social context (Kempen, 1994). It is a condition manifested in both developed and developing countries, aggravated within cities in general. Cities are argued to be places wherein paradoxes such as higher costs for those who are poorest exist (the poor often purchase small units at smaller and more expensive shops); where also the copying of more elitist tastes are favoured (which results in expenditures from income improvements on consumption other than on food and other basic needs); where a greater reliance on state provision is needed, due to the availability of fewer strategies to cope with basic needs; where there are greater exposures to environmental risks and bigger vulnerability to changes in market conditions, among other disadvantages cited in Amis (1995:150-155). Despite all that, cities are still attractive for those who look for choice, as shown in Chapter 3.

The existence of areas of deprivation, with abnormally low standards of infrastructure and/or maintenance, proves that there is a socio-spatial dimension of poverty, besides economic and political ones. In developing countries, the poor are often isolated geographically in certain areas of cities, frequently defined as peripheral by the rest of society. In these areas, a lack of aspirations and of service provision may lead to violence, and the stereotyping of them as areas with social pathology, which are, consequently, avoided by the rest of society (Hill, 1994:70). However, Perlman's (1976, cited in Wratten, 1995:30) classical study of urban poverty in Rio de Janeiro provided evidence that in developing countries the attitude of inhabitants living in peripheral and informal squatter settlements is far from marginal; they showed themselves active in the informal sector of the city economy, well organised and optimistic, aspiring to improve their houses and provide education for their children, and neither politically apathetic nor radical. In this case, poverty was clearly related to the lack of means for the poor to realise their aspirations, about which Satterthwaite and Moser(1985, cited in Wratten:31) also presented evidence.

2.5. Summary and conclusions

This chapter introduces the concept of life chances as a multidimensional concept that interrelates entitlements (understood as lawful modes of access), provision (understood as adequate quantitative supply of things) and ligatures (meaningful connections and motivations). The constitutive elements of the concept are presented to allow an understanding of its potential to contribute to the assessment of the main topic of this thesis: land invasion as a strategy to overcome low income and homelessness.

Brief consideration of the continuous urbanisation of world's population; globalisation of economic, social, cultural and political activities; intensification and globalisation of environmental crisis; changing relationship of the state to civil society are presented, to provide a better understanding of the existing divide between developed and developing countries. In the former there is a strong concern with the entitlement dimension in order to open up and spread out more choices for all, whereas the latter face a permanent struggle to overcome poverty through enhancement of provision and ligatures. Over time modern societies have transformed differences in entitlements into differences of provision; the barriers of status gave way to degrees of status.

As an example, the international and national recognition of citizenship as status, practice and set of rights developed over time is not sufficient to provide citizens with the realisation of their basic right of access to housing. In developing countries the low income housing provision issue has been subject to the elites' political and economic interests, which has resulted in the perpetuation of socio–spatial inequalities. This led the poorest to adopt the creation of informal settlements as a strategy to cope with severe poverty. Human agency, freedom of choice (paradoxically stemming from institutional omission) and social networks are important assets in this process. Through these, the poor have enabled themselves to take part in urban life, despite the difficult trade-offs between health and access to better opportunities of work and education. This fact sheds light on the importance of human freedom as a means of development in poor countries.

The structure of the concept of life chances allows an exploratory approach to the process of informal settlement production, able to take into account individuals' motivations, and was complemented with important variables provided by the participatory concept of poverty. The latter differs from the classical definitions of poverty, based on income and standardised indicators, by recognising low income people as managers of a complex portfolio of assets. The participatory definition of poverty incorporates multiple subjective indicators in order to catch the dynamic of people moving in and out of poverty.

The association of the concepts of life chances and poverty reinforced the interpretation of poverty adopted in this thesis. Here, being part of the modern poor is understood as being prevented from having better life chances, according to mainstream standards. Some assets of the poor's portfolio (labour and human capital, productive assets, household structure and social capital) were superimposed onto life chance's constitutive elements (entitlement, provision and ligatures respectively) and analysed according to their relevance to the spatial aspects of the process of land invasion throughout the empirical chapters. The context in which this theoretical framework is applied is presented in the next chapter.

Chapter 3
The Developing Country City and the Context of this Research

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The developing country city and the context of this research

3.1. Introduction

This chapter sets out the background of this research by presenting general and particular information related to the city in the developing world. Structural conditions are presented in order to introduce the context of informal settlement formation and the main policies to tackle low income housing demands within the developing world, and particularly in Brazil. Then the research's local context is presented through a history of the invasion process in Belém.

3.2. Urbanisation characteristics of the developing world city

After a couple of years of the new millennium, for the first time in human history, the majority of the planet's population is living in cities. Urban population growth rates have added 60 million people each year, and evidence shows that they are and will be concentrated in the developing country cities (UNCHS, 1996, quoted in Hall & Pfeiffer, 2000). For instance, 76 per cent of the population is already urban in developed countries, where there has been a decline of urban growth rates as people move from cities to countryside, whereas 41 per cent of the developing world's population live in cities. It is expected that the urban population in Latin America, Asia and Africa will double between 2000 and 2025 (Hall & Pfeiffer, 2000:3).

However, the urban population increase does not happen homogeneously within developing countries. In this respect, 18 of the 27 mega-cities (cities with more than ten million inhabitants) predicted for the year 2015 will be in Asia, where most of the cities with more than one million inhabitants, 153 of the 358 predicted, will also be concentrated (ibid.). In extreme cases, the agglomerations formed by mega-cities and their surrounding smaller cities are going to inaugurate a urban scale completely new in history. At another extreme, there will be many smaller cities growing faster than big cities in developing countries, some with lower per capita GDP than decades ago. The most challenging problem will be how to tackle management and infrastructure provision demands with decreasing financial resources (ibid.).

Different from Asia, which presents the largest concentration of population living in cities, Latin America and the Caribbean present the highest percentage of urban population in the developing world (United Nations, 1998, quoted in Lima, 200:18). In Latin American, Brazil takes part in the group of the most urbanised countries, with over 70% of the population urbanised (Valladares & Coelho, 1998). In 2000 80% of the Brazilian population was living in cities and even the Amazon

region had its population urbanised (Berquó, 2001; Thery, 2001). Following the patterns of Latin America, Brazil had lower rates of growth in its largest cities than expected during the 1980s, with increasing growth of smaller centres. However, after the post-1980s political adjustments, its is clear that the largest cities have shown steady growth as centres of technology and information management, with enough strength to attract people and capital on a large scale (Rodríguez & Villa, 1996: 41-42; Camarano & Beltrão, 2000).

It is already expected that an informational revolution will happen during the 21st century - (by association of different technologies – computer, television, telephone) – 'into a single medium for the generation, storage and exchange of information' (Hall & Pfeiffer, 2000:7). While this transformation takes place, cities worldwide will assume a position in the network of global interaction and interdependence. The largest cities in the developed world, often called global cities, prioritise advanced services and are core nodes of global exchange of information and control (Sassen, 1994). The largest cities of the newly-industrialised world, called sub-global cities, are receiving manufacturing functions from the former, and performing global level services in selected fields. Large cities in the developing world, called regional centres, are weakly connected to the global network, and perform similar functions in small countries or regions of large countries. These are followed by the 'county towns', 'medium-sized cities which act as service centres for their surrounding areas, but which may also provide some specialised services (such as health care or higher education or tourism) for national or international customers' (Hall & Pfeiffer, 2000:7).

More than ever, cities seem to be ' the driving force behind economic development and the vehicle through which international and domestic investment is channelled for manufacturing, services and commerce' (Payne, 1999:1). Well-networked cities within the developing world have an unequal distribution of income within them. As much as part of them resembles typical developed countries' cities (high-rise city centres, upper class residential areas), the lack of equity and social justice give rise to a flourishing informal sector (squatter settlements and informal economy) (Sassen, 1994). The new international division of labour has loaded the developing countries with decreasing opportunities in rural areas and the primary sector and an increase of factory places, favouring urban growth in a context different to North American and Western European urbanisation (Payne, 1999). Present-day urbanising countries do not control the world economy and deal with much larger populations than developed countries have dealt with during the 19th century, have less consolidated institutions and lower financial resources (Payne, 1999:1). The revolution in transport and communication, and sometimes, political transformations, have also fostered urban growth in developing country cities during the 20th century, allowing suburbs to sprawl and the creation of new capital cities (Hall & Pfeiffer, 2000:7). Besides all this there are specific historical, geographical and

cultural settings which give a proper identity to what looks like a similar problem over all developing countries (Drakakis-Smith, 2000:18; Hall & Pfeiffer, 2000:9).

3.2.1. Socio-economic characteristics

3.2.1.1. Inequality

According to Gilbert & Guggler, in most developing countries 'the state is under pressure to represent a wider range of social groups, but tends to represent certain groups much more than others. In many capitalist countries the state represents primarily the interest of upper- and middle-income groups. But even dictatorships find it necessary to offer some benefits to the poorer sectors of society in order to gain a measure of legitimacy for their regime' (2000:145). In such societies, housing and planning agencies exist to legitimate state policies in the eyes of the less influential social segments (middle and low income groups), transforming the housing issue into a political rather than a technical matter. This is roughly explained by a conjunction of highly unstable patterns of investment, fast urban growth and a lack of policies to achieve fair distribution and optimisation of urban services. As consequence, land prices rise, forming a profitable and secure investment, to the point where land becomes unaffordable even to middle-income groups (Payne, 1999:1; Gilbert &Guggler, 2000:125-126).

In this context, all types of informal settlement are recognised as necessary, and allowed to develop. First of all, the elite representatives, either major political parties or government sectors, find in them an opportunity to acquire political support. Second, the land occupied by these settlements has not threatened the principle of private ownership and its existence, and third it helps to maintain the status quo, avoiding demands for changes in the economic and social system (Gilbert & Guggler, 2000: 148-149). This means that the poor, as a group, have learnt how to benefit from the populist attitude of politicians during electoral times (ibid), favouring a fragmented approach to the housing issue in the city and preventing the adoption of plans as an effective instrument of management. In practical terms the larger the squatter settlement, the larger the chance it has to be quickly improved, inasmuch as it offers a bigger number of votes (Leeds, 1969; quoted in Gilbert & Guggler, 2000: 149). As individuals, the poor also want to pursue land ownership; in order to do so, they occupy and are able to 'upgrade' sites (such as floodplains) considered inappropriate for occupation from the point of view of the other social segments. This land is gradually released to the formal land market; because of this, there are cases in which landowners themselves encourage invasions, either to receive compensation from the government (Perez and Nikken, 1982; Gilbert, 1981b, Cleaves, 1974; quoted in Gilbert & Guggler, 2000:150) or to take advantage of the invaders' work in improving the physical conditions of their land through belated evictions (Mourão, 1987:111-112).

Invasion of public areas is more frequent than that of private, especially when extensive public properties lie close to the city centre (Gilbert & Guggler, 2000: 150), although, to the extent that accessible public land becomes scarce, the reaction to invasions becomes less permissive. All over Latin American cities, the poor are purchasing land in a way similar to other social groups, mainly in speculative subdivisions at the urban fringe. The difference from the formal market is the lack of planning permission and infrastructure provision (ibid.) of this fringe land. Such a process is tolerated by governments because it is recognised that the poor need land and that infrastructure provision and accordance with formal standards is unaffordable by them (Fig.3.1). According to Gilbert & Guggler (2000), this situation keeps the Third World economy functioning. They explain that:

> First, it lets the less poor into the housing market by keeping costs low, in a way moreover that does not threaten higher-income groups. Second, Marxists argue that the very cheapness of spontaneous housing allows the labour force to reproduce itself despite the low wages paid by modern industry (Pradilla, 1976; Burgess, 1978; Kowarick and Brant, 1978). Economic development occurs apace in dependent capitalist societies on the basis of cheap labour costs, and the perpetuation of low-income housing helps to reduce the pressure for wage rises. While spontaneous settlements may offend middle- and upper-income groups, zoning regulations effectively segregate the different income groups. If spontaneous housing does not have to be seen too frequently, its advantages become manifest; it offers cheap labour to industry, a plentiful supply of servants, and the myriad of other cheap services available to Third World urban elites. Thirdly, the existence of spontaneous settlement, especially where there is an active process of consolidation, opens up profit opportunities for commercial and industrial companies. Glass, bricks, cement, tiles, and pipes are purchased in large quantities by the spontaneous settlers and provide a large market for construction material suppliers (2000:151-152).

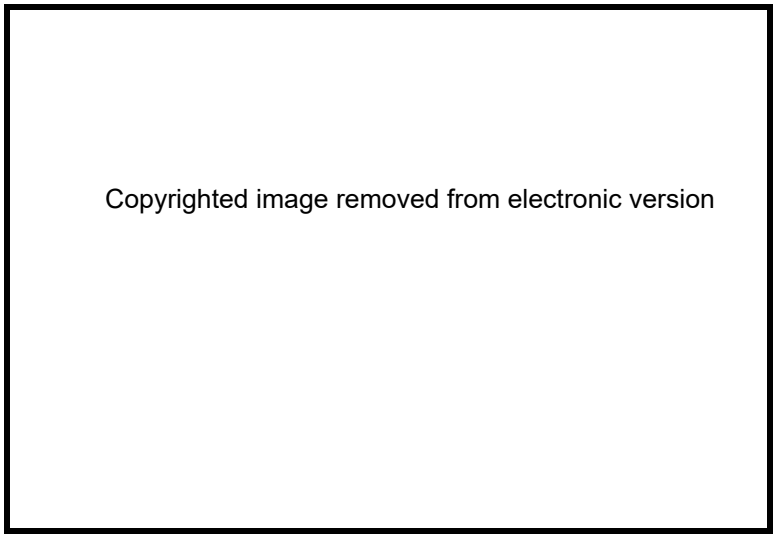


Fig 3.1. Squatter settlement (*baixada*) in Belém, Brazil. Source: Arthus-Bertrand, 2002, February18.

The maintenance of low wages is interesting to central governments in macroeconomic terms, while local governments are impotent to sort out the situation either by providing housing and/or upgrade programmes or by tackling political causes of housing shortage. Local governments suffer pressure from the upper class and the construction industry to eradicate squatter settlements, mainly when

the squatter settlement occupies land destined either for important public works or is too close to upper and middle income group dwellings. At present, the issue of low income has reached levels unbearable even to central governments' interests; low wages have helped production but prevented consumption. This tension has resulted in the search for alternatives for low-income housing and the creation of credit accounts to finance upgrade and housing provision programmes by international banks and institutions (ibid.).

This broad background offers a reasonable understanding of the issue of inequality within developing countries. The massive concentration of resources in upper and middle income groups is physically expressed by an equivalent concentration of infrastructure in the areas in cities where they live. The poor are benefited indirectly only by this infrastructure, when they settle close to served areas (Gilbert & Guggler, 2000; Lima, 2000). Yet over time and under 'favourable conditions' the poor have proved able to improve their housing's physical conditions (Gilbert & Guggler, 2000) (e.g. by consolidating flood plains or transforming a shack into a spacious and reasonably serviced home). Perlman (1976) and Turner (1976) have produced evidence against the deterministic concept of a 'culture of poverty' - Lewis's (1966, quoted in Gilbert & Guggler, 2000:118) idea that the poor are trapped in their condition of poverty by apathy, fatalism and lack of aspiration (Portes, 1972, quoted in Gilbert & Guggler, 2000:118). In Perlman's and Turner's Latin American experiences, they have observed that the poor act in a rational and sensible way in order to overcome poverty. Their seminal works give rise to the recognition that the poor are the best advisers about their own needs, that they have perseverance, bravery and ambitious aspirations, and if they are to be helped, they should be helped by government agencies, according to their particular needs. Turner explains that shelter should not be evaluated only by its physical qualities, but also by its suitability to a family's budget. A shack is usually more supportive to a low-income household than a too expensive (for its inhabitants' income) good quality house. When a house's mortgage compromises 50% or more of a household's income, it is oppressive rather than good housing (Turner, 1976: 56-59).

Moreover, if the shack is built in the backyard of a 'godparent' with services provided, and the family is young and healthy, there is a greater chance that they will own a better house in the future. Turner (1972, quoted in Gilbert & Guggler, 2000: 119) also emphasised the existence of trade-offs used by the different income segments. In the case of low-income groups, proximity to unskilled jobs is much more important than ownership and high quality construction standards. For this reason, a higher degree of flexibility should be offered to this group in relation to housing standards policies, somewhere in the intervals between the autocratic large-scale enterprise and the anarchy of auto-construction (Turner, 1976: 113-126). Nevertheless, for those who are very poor, there is no choice; they have to settle wherever they can obtain a cheap rented house, as choice is

determined by income level and the conditions of the city housing market. In order to increase choices for the poor, either income has to improve or the housing land market has to change (Payne, 1977; Gilbert & Guggler, 2000).

3.2.1.2. Illegality

Hall and Pfeiffer (2000) demonstrate that at least 40% of the economically active urban population in Asia, Africa and Latin America either live or work informally (female and child informal labour were not considered, nor informal work supplementary to formal occupation). This means that more than half of the economically active population of developing world cities is both employed in the informal sector and lives in informal settlements (ibid:73). As much as this is an expression of urban poverty, and sometimes of mismanagement, it also expresses creative responses to urban crisis, and a phenomenon that needs to be better understood to better be transformed (ibid.).

Differently from the formal system, the informal sector neither has clear regulations nor pays taxes or contributes to social services; because of that it is often seen as illegal and undesirable by middle-income societies (ibid.:71). Despite having no rules, the informal sector has its strength, recognisable by its low-cost expertise, proper rules and systems of controls and sanctions. For instance, at the individual level, to be cut off from an informal network of support means to be without security and assistance during periods of vulnerability (ibid.). However, the informal sector; is never completely disconnected from the formal sector; the idea that activities are placed in a continuum between these two extreme positions through which evolution from informality to formality occurs is the most accurate one (Hall & Pfeiffer, 2000;71-72). Street vendors who pay taxes in Africa or who have an ID card in Colombia, and workers who are in the lower segments of the formal sector, receiving low wages and having little job security, are examples of this transitional process.

The case of informal settlements is not different. As an example, Perdomo and Bolivar (1998) describe how ‘barrios’ were rejected during the 1970s in Caracas, as being considered illegal (unregulated, uncontrolled and informal) housing areas. The authors stressed that the establishment of formal standards were biased in favour of elites, and explained how inhabitants of informal areas began to be criminalised just for living there. However, during the 1980s, the population of ‘barrios’ increased and acquired political significance, and in a context of economic crisis the distinction between illegal/ legal started to fade. Eviction became impossible, due to the clientelistic relationship[1] between inhabitants and politicians, even though this was considered a solution from the urban planning perspective, which regarded the ‘bairros’ as ‘vacant’ land for a long period. The lack of adequate policing within these areas created the stigma of violence in them. But

[1] A clientelistic relationship is based on the mutual exchange of physical improvements provision, not part of official

this has been shown not to be the case; violence was not the norm, and its frequency was comparable to that of any other area of Caracas (although internal cases of violence within 'bairros' could be sorted out by the informal extermination of the criminal). From the point of view of the formal legal system, the 'bairros' are lawless places, but there was evidence that the solidarity of a co-operative system within them has actually created another type of law. This is a law of the 'bairros', made of rules of social interaction which express mutual respect, and the existing stratification of their population (Perdomo & Bolivar, 1988: 123-138).

The presumable offer of more choices of work within cities explains the voluntary movement of people from villages towards cities (Hall & Pfeiffer, 2000). Seabrook (1996; quoted in Hall & Pfeiffer, 2000: 14 - 15) presents two different perceptions which low income people have about moving from a village to a city. The villager says that life in a village is better, but there are fewer ways to obtain food. In his evaluation, one may find some work, and even beg or steal, in a city. Conversely, a migrant woman living in a city in economic conditions equivalent to the villager, says that to stay in the city is a kind of commitment. Everybody expects her to succeed and make her life in the city (ibid.). The present poor have the same dilemma, choosing between better choices of employment and worse living conditions within city, as the 19th century's poor. But they rely much more on the city's informal sector, and perhaps are more socially and spatially segregated. Depending on the efficiency of the city's growth management in destination cities, the quality of the urban environment created by poor migrants may be very different from the living standards of the non-poor. Under uncontrolled and unplanned growth conditions, the following description of the life of the present city poor is very evocative:

> They get by, somehow or other, by doing odd chores and performing odd services: running errands, selling a few things by the roadside, finding any odd job that comes along. And they live overwhelmingly in informal settlements, some of them vast, on land that they have themselves occupied, without benefit of legal title or any official permission, and in houses that they have created and then improved with their own hands. They depend absolutely on no one but themselves. They have built their own city, without any reference whatsoever to the whole bureaucratic apparatus of planning and control in the formal city next door, and they are rightly proud of what they have achieved.
> But all too often, because they were not allowed to defy the authorities in any place that mattered, they have occupied the worst pieces of land, the places no one else ever contemplated developing: the sides of main traffic streets, the borders of railways tracks, perilous hillsides prone to mudslides, alluvial flats prone to flooding. They are prone to all kinds of hazard: their children may all too easily be killed or maimed by passing trucks or trains, their homes may be swept away by mudslides or destroyed by floods or buried under earthquake rubble, they may fall prey to the diseases that come from primitive sanitation and polluted water and from nearby toxic sites, they may suffer robbery and violence because the city police do not recognise their existence. They know these risks, but they have no choice (Hall &Pfeiffer, 2000:16).

programmes, for an informal settlement, in exchange for inhabitants' votes for politicians in charge in the following election.

3.2.2. Informal settlement typologies in Latin America

It is opportune to differentiate between the most common types of informal settlement generated within the universe of informality. Burgess (1985) discusses the difficulties of classifying and identifying informal settlements, using the vocabulary of current literature. He shows how usual criteria such as form of housing production, material condition of the housing stock and tenure and physical legality give an imprecise classification when applied in the Latin American context. Most of the difficulty in adopting these criteria is due to their concern with just one aspect of the settlement and to the fact that they express only the moment of classification, regardless of either the original or following stages of the settlements' evolution. The tenure and infrastructure provision perspective may be used as an overarching criteria, but it is limited by the changes over time either of land ownership conditions or to legal requirements from different levels of a legal system in constant transformation. Over years, a squatter settlement can become a 'pirate' settlement, and from the infrastructure requirements point of view may be in accordance with a new law, but not fully legal, according to a former law. Hence, settlement classifications using legal criteria demand a choice of the most important aspect of the law for analysis (see Table 3.1).

Table 3.1. Settlements' classification, according to Burgess (1985: 288-296)

Type of settlement (legal criteria)	Tenure condition	Physical standards	Form of housing production	Material condition of the housing stock
Squatter settlements	Land occupied illegally, without transfer of ownership rights	Not in accordance with physical legal standards	High incidence of artisanal housing	May start as a shantytown and evolve differently
'Pirate' (clandestine) development	Land generally sold under legal conditions	Not in accordance with physical legal standards	Mixed	May start as a shantytown and evolve differently
Legal settlement	Fully legal transfer of land ownership	Fully in accordance with official standards of infrastructure provision	High incidence of manufactured housing	Formal shelter

It is not possible to classify a settlement by the amount of self-construction or degree of industrialisation of building material once the latter vary widely from one household to another, and even more after the first stages of settlement consolidation. To increase the confusion, words applied to the description of the material condition of the housing stock are ambivalent; besides describing a physical stage, they also carry tenure and infrastructure provision connotations, or conditions of social pathology. As examples, we have shantytown, tugurio and inquilinato zones or slums (see Table 3.2).

Table 3.2. Examples of ambivalent vocabulary, according to Burgess (1985: 291-292)	
Shantytown	Shelters made of temporary, traditional materials and throwaways
Tugurio	Construction made of materials with a short life, absence of legal property title, lack of sanitation, high densities
Slum	Building adapted to provide dwellings for a large number of households who share services. They exist in either squatter or pirate settlements

Time plays a very important role in the settlement identity, preventing classifications based on existing conditions from being successfully adopted. For instance, depending on the landowners' attitude, squatter settlements which are twenty or thirty years old may have differing situations of legal ownership and consolidation dynamics, although they started with similar conditions. The squatter settlement, regularised according to land ownership, becomes a 'pirate' settlement, allowing the inhabitants to gradually build their houses and public facilities, which if done according to urban norms, qualify them as fully legal settlements. To overcome this difficulty, Burgess (1985:296) uses a genetic principle (based on the settlement's process of formation, rather than on existing conditions of legality at the moment of classification) as a classification criterion. Nevertheless, classification based on the genetic principle creates the difficulty of establishing when a settlement was formed. Informal settlements are usually formed over a long period of time, and the legal conditions of their different parts can be very varied; areas of legal ownership may coexist with illegal squatters, and squatters may coexist with 'pirate' settlements.

A frequent source of confusion at this point is the usage of the term *invasion* as a synonym with squatter settlement. These expressions refer to different aspects of the settlement's nature. Invasion 'refers to the mode in which land has been occupied, whereas squatter settlement refers primarily to a condition where legal rights to the ownership of the land have been infringed' (Burgess, 1985: 297). From Peruvian and Colombian experiences it is possible to illustrate these differences. In Peru almost all squatter settlements have been generated by an organised mass occupation of land carried out over very short periods of time, while in Colombia squatter settlements 'are not (the*)* result of organised mass seizures of land occurring overnight, at weekends or on public holidays, but the result of a gradual process of family-by-family occupation of vacant lands over a period of time, a process know as colonisation*'* (ibid.: 297). However, hybrid settlements are as common as the pure ones; for instance, an invasion may be expanded by a family-by-family occupation, when official resistance starts to relax.

Moreover, the possibility of taking into account rights of ownership and possession of land at the time of a hybrid settlement's formation adds exponential difficulty to the classification. This difficulty is due to the informal land market created by invasions, fed by squatters who occupy more land than they need personally in order to sell the rights to this land to new inhabitants. Sometimes this is the main motivation of a settlement's formation; in these cases, the invasion is called a

professional invasion. When squatters already have a house elsewhere in the city, the distinction between a squatter settlement and 'pirate' settlement becomes more difficult (Burgess, 1985). This distinction also fades when the organiser of a pirate settlement sells plots which have an obscure land ownership status (either mortgaged land, or land under contest between two owners or inherited land not yet shared out), and takes the money for himself/herself (in this case he/she behaves as a professional invader). The buyers of an occupied plot pay for the transfer of any improvement done (from plot cleaning to an already built house) by the original invaders, independent of the plot's ownership. This is a quite legal transaction according to the legal system of Latin American countries such as Colombia and Brazil (more information about tenure regularisation process in Brazil and in Belém is given later in this chapter and in Chapter 8). It is common that the value established for these improvements is over-estimated. It is more a recognition of the degree of the settlement's consolidation and the development of land commodification than of legal ownership status. It recognises, even informally, rights of possession.

The main difficulty is always how to classify the hybrid settlements between the extreme categories, where similarities are as usual as differences. Even when a genetic classification is adopted, it is necessary to choose one aspect of the settlement to validate the classification. Therefore Burgess (1985) suggests use of the classification created by Peterson (quoted in Burgess, 1985:303), to avoid the imprecision of classifications that require legal criteria. Peterson's classification starts from the act of land subdivision and introduces three categories, divided according to infrastructure provision (infrastructure provision is recognised in the literature as the most important issue behind land ownership) (Table 3.3).

Table 3.3. Peterson's classification of land subdivisions (unfinished and unpublished PhD thesis, quoted in Burgess, 1985:303)

De facto occupations	Improved subdivisions	Unimproved subdivisions
Illegal occupation of plots	Settlement served with infrastructure (at least water and either sewer or septic tanks)	Settlement without or with incomplete provision of infrastructure

3.2.2.1. The consolidation process

According to Gilbert & Guggler (2000) the consolidation process is a process of gradual housing condition improvement, favoured by absence of threat of eviction. A settlement which starts as a shantytown is gradually transformed into an ordinary suburb of the city, where houses are improved and community and political pressure on local agencies results in provision of water, power, drainage, buses, schools and health centres. The progress is usually slow, but consistent. Inhabitants invest money in their houses when it is available and avoid rent payment when money is scarce. Inflation may rise, but the investment in the house is safe (Souza, 1998). If it is possible, rooms can be rented to increase household income, or a shop can be opened in the front room.

These settlements offer a great deal of flexibility to the poor; a small family may slowly build a large and comfortable house or a big family can gradually build a house of the required size. However, Gilbert & Guggler (2000) raise questions about the general conditions that make this process successful in developing world cities. It is not known how it varies from city to city, whether it is a phenomenon of the more prosperous Latin American cities, or who actually are the consolidators. What is known is that a certain degree of class heterogeneity is needed to foster consolidation (Payne, 1977; Valladares, 1978). When the better-off move out, improvements are slower. They can when present create opportunities for the opening of local shops, for casual employment, and add strength to community demands for infrastructure provision. Conversely, these better off may benefit from the poor, by subletting rooms to them and causing them an undesired extension of a stage that should be temporary within the cycle of low income housing provision (Gilbert & Guggler, 2000), which moves from rent, passing through occupation, towards consolidation. This research does not provide answers to these questions but is focused on the role that the built space itself plays in the consolidation process and how this space is related to its inhabitants' life chances.

In accordance to Peterson's argument, Drakakis-Smith (2000) adapted from Potter and Lloyd-Evans (1998) the table 3.4 which summarises the relationship between significant variables in settlement consolidation and consolidation stages, comparing informal settlements against formal ones. It shows the increase of resources and diversity that characterises the process of consolidation.

Table 3.4. Characteristics of informal and formal shelter

Variables	Stages of consolidation		
Settlements' characteristics	informal		formal
	early	consolidating	
Resident's income	low	diverse	middling
Builders	users	Users/paid labour	contractor
Mode of production	artisanal	mixed	industrial
Value	use	commodifying	exchange
Tenure	Illegal occupation	Mixed (inc. rent)	Mixed, except illegal
Infrastructure	little	Improvised/illegal	provided
Legal status	illegal	mixed	legal

Source: Drakakis-Smith (2000:157) adapted from Potter and Lloyd-Evans (1998)

3.2.3. Usual government approaches to informal settlements

Official responses to informal housing have been quite similar within the developing world's cities (Gilbert & Guggler, 2000; Burgess *et al.*,1997b). The first reaction was demolition of informal

settlements and their replacement by conventional houses in official settlements, which usually coincided with the adoption of planning regulations inappropriate to low income housing conditions. There was the belief that economic growth plus good administration would overcome the problem of informal housing, and national plans produced by economists until the 1960s did not even mention the housing issue (Payne, 1977; Gilbert & Guggler, 2000). Spatially, housing was translated into segregation in country and city levels, through the building of planned cities (usually capitals), and neighbourhood segregation within cities, according in the beginning to race, ethnicity, and caste (as in Asia and Africa), and later to affordability (as in Latin America) by inhabitants. Urban planning became a practice in Latin America to protect the elite areas through instruments such as zoning laws, through which the planned districts of the wealthy were clearly separated from the informal settlements (Villaça, 1999; Gilbert & Guggler, 2000).

The segregation policy was often complemented by the demolition of undesirable housing, to discourage migration and to promote urban renewal following the introduction of zoning codes. These policies have not succeeded very well in providing housing for the urban poor. The alternative sites given to the former inhabitants of demolished areas were not considered suitable, due to their distance from working places and the lack of affordability of mortgages. Inside the formal system it was also harder to achieve a large house, and as a reaction the 'benefited' started to sell their units and to come back to conditions similar to those of their previous informal settlements (Valladares, 1978; Gilbert & Guggler, 2000).

This has been considered the worst of all official strategies to tackle informal housing: 'demolition without replacement intensifies overcrowding and increases shelter cost' (Abrams, 1964:126, quoted in Gilbert & Guggler, 2000), precisely the situations the government presumably wished to avoid. Urban removal plans have increased the cost of transport, services and rents, and have dismantled the informal networks of support of low income inhabitants. Government action misunderstood low income people's real needs and provided houses with too high architectural standards; over time these official settlements were bought by middle income inhabitants, benefiting the poor only by the money which they received as payment for their houses (ibid.). The construction of official settlements was also part of a policy to enhance employment opportunities, adopted in developing world countries such as Colombia and Brazil, and funded by index-linked saving plans. This helped to boost the economy, but may have stimulated speculative housing developments and further segregation of income groups (ibid.; Valladares, 1982).

During the 1970s, recognition that governments, in capitalist developing countries, were incapable of providing housing for low income inhabitants, as demanded by removal programs, dawned (ibid.). Self-help policies were then reinforced, and architects and major funding institutions

accepted Turner's advice: that more should be provided in terms of infrastructure, whereas the building should be left to the inhabitants themselves (Linn, 1983; quoted in Gilbert & Guggler, 2000). This generated two policies, one to upgrade existing settlements and other to facilitate the development of new settlements (called site-and-services), expected to offer more resources and security to low income people. In favourable conditions 'a site-and-services programme would offer a family a plot of land, gradual servicing, access to credit, advice on construction and materials, all at a price not beyond the family budget. The security afforded to the family would allow consolidation to take place and community action programmes to be introduced. Government agencies could supply more people at the same cost if people no longer occupied land on hillsides and river-valley bottoms which are expensive to service' (Gilbert & Guggler, 2000:141).

Authors such as Doebele and Peattie (1976, quoted in Gilbert & Guggler, 2000), consider that site-and-services and squatter-upgrading constituted a step forward in developing country housing policies. However, experience has shown that these policies are not a complete answer to the problem. Other aspects such as administrative efficiency, land market control and review of urban planning policies (taxation and zoning) should be considered and modified in parallel. Authors such as Drakakis-Smith (1976, quoted in Gilbert & Guggler, 2000), consider that self-help projects help to maintain the status quo by satisfying the minimum housing needs of the poor. Doebele and Pettie (1976, quoted in Gilbert & Guggler, 2000) argue that these projects may homogenise inhabitants' economic situation, threatening the positive affluence of the leading poor and slowing down the internal demand for commercial activities and for infrastructure provision. Laquian (1977, quoted in Gilbert & Guggler, 2000) reminds us that if a huge quantity of informal settlement is incorporated into the formal market, its price would rise and the official site-and-services programmes would be pushed to the cheapest most peripheral land. Too often the housing issue is more a political than a technical matter (Gilbert & Guggler, 2000; Payne, 1984).

The failure of socialist countries also to provide low income housing has exposed the problem of lack of partnership between public and private sectors (Currie, 1971; Harms, 1982; Mathey, 1989; quoted in Gilbert & Guggler, 2000). Payne (1999) shows that the private sector (commercial developers, private landowners, informal developers) judges the public sector (central and local government agencies) to be incompetent, inflexible and corrupt, while the public sector judges the private sector to be speculative, and sees itself as responsible for protection of low income people's interests. But neither of them is able to tackle the issue of low income housing provision alone. Payne (2000) poses the solution of partnership, emphasising the need to understand the role of the many actors involved in housing production, inclusive of the third sector, the non-governmental organisations (NGOs) and community-based organisations (CBOs).

3.3. The Brazilian context

3.3.1. The historic Brazilian informal typologies and the first Brazilian policies for low income housing provision

Taschner (1995) identifies three basic historic types of low income housing in Brazil: slums (tenements), squatter settlements (illegal occupation of lands) and peripheral low income housing tracts (ibid.:187). The author explains the origin of the informal housing process in Brazil, going back to the second half of the 19th century when slavery was abolished (in 1888) and important political, economic and cultural transformations occurred. The process of industrialisation started and the most important cities (Rio de Janeiro and São Paulo) began to be beautified, without any regard to housing provision. Freed slaves and immigrants arrived in these cities, looking for jobs close to the city centres and causing a rate of growth of 4.07% p.a. in Rio de Janeiro and 6.26% p.a. in São Paulo during the period of 1870 to 1890.

The process of beautification of Rio de Janeiro during the first decade of the 20th century renovated the city centre by demolishing about 550 old buildings and relocating the poor in the hills. In São Paulo, beautifying and sanitising plans were carried out during the 1930s, when decisions related to public transport improvements and urban structure favoured the spread of pirate peripheral settlements. This process in São Paulo made the slum the first mass housing solution for low-income people, and squatter settlement in the hills the next alternative in Rio de Janeiro, and of pirate settlements on the periphery the next alternative in São Paulo. The construction of new cities in Brazil has added a new component to the issue: the official assumption of housing segregation as a policy. Belo Horizonte (capital of the State of Minas Gerais) and Brasilia (capital of Brazil) did not provide housing for their civil construction workers, as they were seen as temporary. Before these cities' inauguration their sites already held squatter settlements. These were removed from the city centre to the periphery in Belo Horizonte, and to satellite cities in Brasilia (an official initiative to protect the integrity of the modernist Pilot Plan (ibid.). This experience was repeated by official settlement construction in many Brazilian cities during the 1960s and 1970s (Kohlsdorf, 1985:57-69).

These experiences marked the establishment of urban planning in Brazil as a tool of the elite, enabling it to impose its interest and solutions on Brazilian cities (Villaça, 1999; Maricato, 2000). Plans were designed to sanitise and beautify the bourgeois city, either as a new city or as an elegant district, and improvements were protected from undesirable neighbourhoods through zoning laws. This position was maintained while the elite was powerful enough to clearly impose its

interests. When it was not possible any more, a whole hierarchy of plans was created on behalf of efficiency, and at the city level master plans replaced the beautification works plans. Beautification projects were replaced by urban diagnosis and broad mass plans (Villaça, 1999). The plan became a figure of speech, to raise or hide points according to convenience, in which housing, sanitation, transport and drainage were not central to policies. Planning and management were and still are considered apart from each other, codes and laws increased in complexity without a reciprocal attempt at efficient inspection, increasing the gap between the existing islands of first world infrastructure (like the River Pinheiro's banks in São Paulo, where the TV Globo's studios are located) and the illegal city (Maricato, 2000).

Plans and laws are put into effect according to circumstances; the richest zones of the Brazilian cities receive much more attention than their peripheries and poor localities. The elite recognises the need to give 'cheap choices' to the urban poor, and allows flexibility in the law in order to keep costs of production low. This culture, plus other forces of backwardness such as corrupt mega-building works enterprises, over-charged work, private land and market valorisation thanks to public investment, and replacement of the real city by its symbols, continuously reinforces inequality and illegality within Brazilian cities (ibid.).

Moreover, Pugh (1995) informs us that, during the 1980s, Brazilian economic inequality worsened the social impacts of the structural adjustment policies' implementation (big loans followed by macro economic mismanagement, large external indebtedness to international commercial banks, global economic recession and consequential lower export earnings). During this period, living standards decreased and impoverished middle class and low income people had to cope with high rates of inflation, high levels of interest rates and economic recession. This resulted in the economic collapse of the housing market and formal finance system, with the elimination of the Brazilian Housing Bank, created during the 1960s to develop the housing sector. Income and poverty levels were heavily affected, with some 5 percent of Brazilian population consuming 35 percent of the GDP, while 70 percent had less than 30 percent of it (Pugh, 1995:47). Dupas (2000:453) adds that although 64% of the world's countries have lower per capita income than Brazil, they have just 10% of their total population in similar conditions of poverty. According to Gini's Coefficient, only Sierra Leone, Jamaica, the Central African Republic, Guatemala and Paraguay, have equal or higher income inequality than Brazil's (ibid.).

3.3.2. The land invasion process in Belém

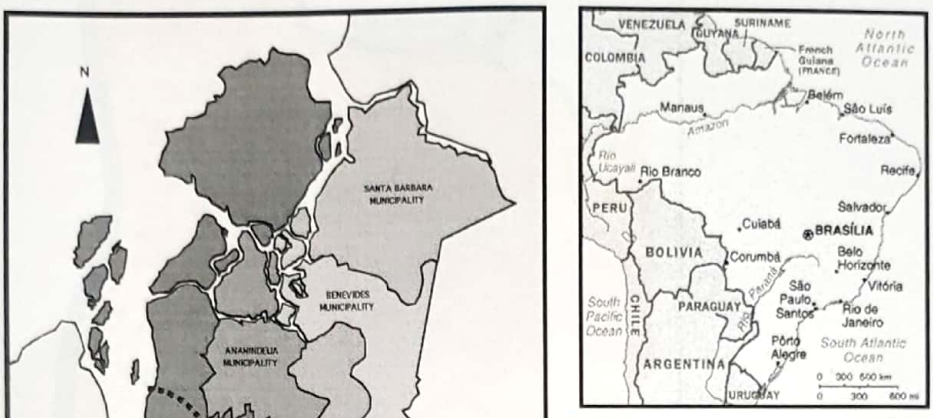


Fig 3.2. Left: Belém Metropolitan Region (dashed arc marks the first league, present city centre). Right: Location of Belém in Brazil. Sources: Mercês, 1997 and http://www.Pib.utexas.edu/Libs/PCL/Map_collection/americas/Brazil_sm97.gif

The city of Belém was founded in 1616 on a small portion of high land, due to the strategic concern of the Portuguese army about invasions in the north of Brazil by other European nations (Ferreira, 1995:35). The city was founded on a 'corner' of a peninsula limited by the Guamá River southwards, Guajará Bay westwards, and Maguary River northwards (Fig 3.2). This peninsula is located on a basin formed by successive layers of sediments, compacted through thousands of years, in the mouth of Amazon River; its thickness today reaches 4000m. The natural site has been sculptured by the action of water streams, rivers and the ocean. The regional geological process of formation generated two morphological units of land where the city is now located: the firm lands, with levels between 4 to 20 metres above the ocean level, and the plains, waterlogged daily by small rivers that penetrate the site, with levels up to 4 metres above ocean level. These plains are surrounded by Guamá River, Guajara Bay and small rivers that cross the continent. During the floods, the clay held in suspension in the water is settled on the land, in a natural gradual process of landfill (Fig. 3.3) (Ferreira, 1995:17-32). Later in Chapter 6, how the urbanisation of these lands has changed the rhythm of the site's natural evolution is shown.

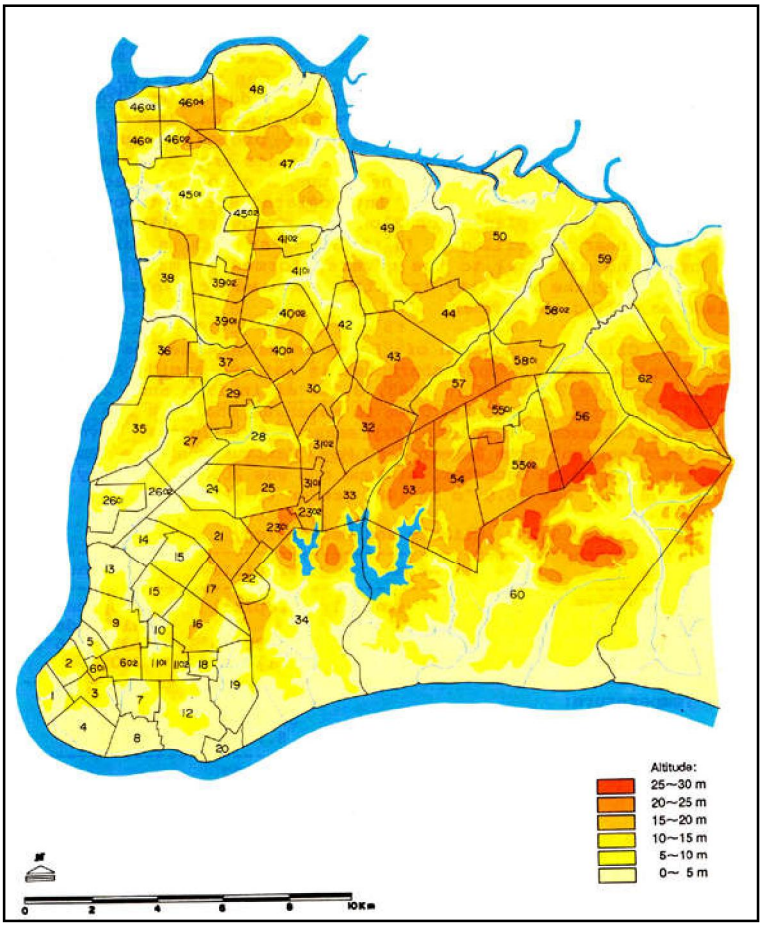


Fig 3.3. Land Form of Belém
Source: JICA (1991: 31)

The occupation of Brazilian lands in the 17th century happened according to a system of concessions of the entire country to municipalities and to families of colonisers by the Portuguese Crown. The land owned by municipalities was to be managed and exploited either by themselves or by 'foreiros' (people, religious orders, and other institutions to whom concessions were granted). From 'foreiros' were expected economic developments to exploit the land, and to them was given the right to enslave Africans and native Amazonians. This tenure system was abolished in the whole country by the proclamation of independence in 1822, with a few exceptions such as Belém, where the municipality up to the present day has retained the power to grant lands[1]. The system was useful to colonise huge areas of virgin land in colonial times, when there was enough land available and a slow bureaucratic process of concession. It contributed to creation of a tradition of land occupation before title regularisation; this is practised to the present day, and has been

[1] Private land ownership has been protected since the promulgation of the law of land in 1850, when, contradictorily, occupation was still the procedure for acquiring land (Baldez, 1996; quoted in Maricato, 2000). This law was a result of a conservative victory, supported by the big properties' landowners. It determined the demarcation of public land, just when it was convenient to confirm the existing private properties and benefit landowners. Many agencies were created and closed to put the law into effect, and in 1891 the responsibility was transferred from the central government to the states. Up to the present, according to Maricato (2000:150), land is a not solved issue in Brazilian society, and still associated with the colonial '*coronelismo*', defined by Ferreira (1999) as the power and influence of landowners in political and social life of certain areas of Brazil (p. 560). The big properties have survived for four centuries and created an inheritance of invasion of public land as part of the urbanisation process.

generally called 'land invasion', despite the nature of the land (i.e. whether belonging to private or public owners) (Mourão, 1987:85-87).

As part of the concession of land to Belém municipality by the Portuguese crown, in 1627 the local authority of Belém received a donation of the land on which the city was to be developed. This piece of land had a radius of one league (6 km), and was enough to begin the process of interiorization initiated in the middle of the 18th century and continued until the beginning of the 20th century. Interiorization[2] started when the city became the capital of the Province of Grão-Para and Maranhão, spreading along the direction of a spike of high land. Parts of these new areas were left out of the land donated to the municipality. Instead, they were donated to a few families by the Portuguese crown in the same period, on condition that landowners would defend and effectively use the land (Fig 3.3) (Mourão, 1987:30).

From the second half of the 18th century, public works to contain water courses and reclaim land were started, beginning a tradition that increased over the following centuries. During the first half of the 19th century, the landfill of the first plain was built upon, following hygiene and sanitation principles, and located close to the site of the city's foundation. At that time local government took the decision to change the natural watercourses and environment according to alien standards, despite the existence of proposals oriented to maintenance of existing water streams. This created a strong tradition of drainage based on canals and landfill construction, followed up to the present (Mourão, 1987:26;Trindade, 1998:30-31) (Fig 3.4).

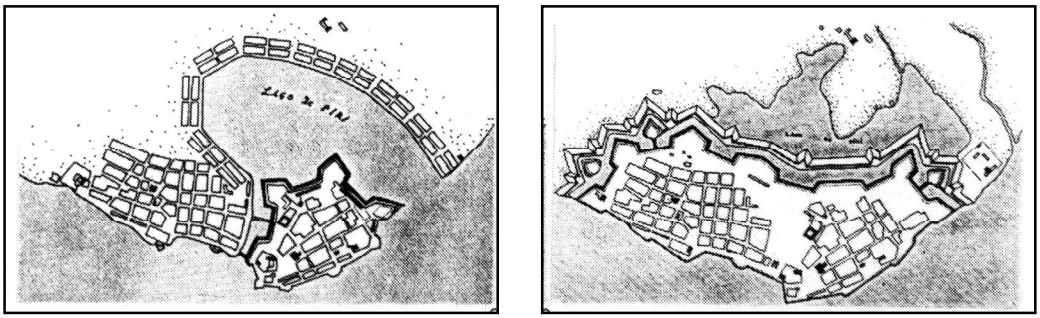


Fig 3.4. Drawing of proposals to keep original environmental conditions of the site of Belém in the first half of 19th century. Source: Lamas (1992:185)

Occupation of high lands, (corresponding to geologically firm lands), mentioned above was guided by a drawing developed in the 19th century, during the wealthy rubber exploitation period between 1840 and 1920. The drawing suggested no special treatment for the plains, but the alignment it

[2] 'Interiorisation' means occupation towards the continent, in opposition to occupation on the river banks.

established for firm lands was so successful that it is still followed today and guides the occupation of firm lands inside the whole of the first league (Fig 3.5).

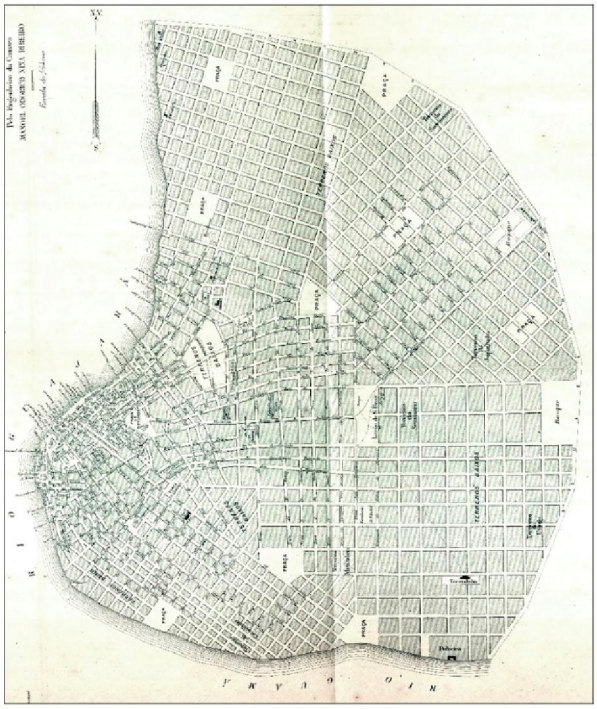


Fig 3.5. Drawing of expansion of the first league (Muniz,1904)

Wealth generated by the rubber economic cycle supported the provision of infrastructure in the commercial area and the occupation of new, elegant districts, set out according to the drawing mentioned. These districts were provided with larger spatial standards than those of the old city built by Portuguese colonisers, due to lower land prices and the greater availability of land. The intervention of the city mayor in urban improvements was favoured by political and economic conditions; besides new infrastructure, a new municipal Code of Practices established building standards (aesthetic, hygienic and technical) and desirable urban behaviour for 'citizens' (most based on European standards). All the improvements in beauty and infrastructure pushed low income inhabitants towards the furthermost places, to the boundaries of the city grid, which coincided with the limits of the firm land available inside the first league. Within these boundaries, the highest portions of the plains were occupied by segregated urban uses, such as hospitals for insane people and for infectious diseases, a cemetery, and a leprosy asylum on land conceded to a religious order, revealing a clear process of social segregation through spatial occupation. The areas with levels up to four meters above ocean level were avoided, leaving huge unoccupied areas inside the first league. (Ferreira,1995:35-54,60-70; Mourão, 1987:88-89).

In the decades of the 1930s and 1940s when the rubber boom had ended, the city was impoverished and empty compared with the richness and growth of the second half of the 19th

century and first decades of the 20th . Some remaining rich families asked for grants of portions of waterlogged areas from the municipality, in order to prove they were landowners and eligible for land-based titles which would be respected in Europe. These areas were donated to them by local authorities for agricultural purposes, and since then these families have been the biggest private owners of land in waterlogged areas of Belém. It is necessary to say that, after this process, Belém was the biggest city in the whole of Brazilian Amazon, and the place which offered the best health services and opportunities for education. In a context of regional deprivation, the richest people went to Europe to access these same services, while low-income people aimed to live in Belém (Castro, 1994).

It was clear that Belém's elite adopted external models in ruling the new society which had been created. Power was centralised by those who owned land, all minorities were excluded from decision-making processes, and elegance, health and cleanliness were conditions created only to attract foreign investors. There was no true democracy; the universal vote was put into effect only in 1933, although even then illiterates were not given it (Silva:1982). With economic impoverishment, the local political scene was dominated by rivalries, and during the decade of the 1950s a local dictatorship was established in Pará State, with important consequences for its capital, Belém (Rodrigues,1979). It was gradually more difficult to separate state and city government from each other. There was no impediment to actions (referring to land use) of landowners; ownership was used to determine land uses, and wealth to determine social and political power. To other inhabitants and migrants, the opportunities for choice were dependent on their willingness to face the cost of living in segregated conditions.

During the Second World War changes happened to the city. Supported by the remaining capital from rubber exploitation, local industries were improved, because of the lack of imported products, and military bases were built just outside the city grid. This began the formation of an institutional belt around the first league, surrounding what nowadays constitutes the city core. This fringe belt became a barrier to city expansion, and as available land declined, three main spatial strategies were identified: a) poor people arriving in the city intensified the occupation of waterlogged areas (through family-by-family occupation, squatter and pirate settlements); b) middle income earners began to intensify grid use by subdividing plots, and c) high rise buildings for rich income dwellers were built on the main roads of the city centre (Cal, 1987; quoted in Cardoso,1990: 9) (Fig. 3.6).

Fig 3.6. Skyline of Belém's city centre, seen from the bay. 2000

Land located outside the grid and the institutional belt was donated to the municipality by government, as the second league (called here expansion area), in 1892. But at the time this happened most of this area was already occupied as private property, mainly by farms which followed axes defined by two old railways: one directed to the north and the other towards the east. Only land without use was considered to belong to the municipality, and the piece of land corresponding to the second league could not be parcelled out in any organised fashion.

During the 1960s military dictatorship began in Brazil, and big projects of mineral exploitation were launched in the Amazon region, accelerating urbanisation in Pará State in a way distinct to other Brazilian states. Further, the country's biggest dam was built in the state during the 1970s to generate electricity. These activities attracted big contingents of workers, who, once laid off, moved to new-born cities built along the new roads, and later to Belém, looking for better opportunities. A new network of roads was built to integrate Amazon with other regions; a process of speculation in land expelled people from the countryside, and contributed to the uncontrolled growth of cities (Mourão, 1987:89; Browder & Gedfrey, 1997: 203-220).

This was the time of the adoption of planning at all government levels in Brazil. At the national level, agencies were created to manage housing, infrastructure, urban transport, etc.. This organised public action, but also favoured repression and control by higher levels of power (Mourão, 1987:64-69). At the local level, a planning company was created in Belém to draw up metropolitan policies, although popular political power was almost non-existent. Local mayors were not directly elected; they were appointed by state governors, who, most of the time, were appointed by the federal executive. Social segregation became visible in Brazilian cities. Different types of power were in the same hands, while city inhabitants were powerless. The first election for state governors after dictatorship ended happened in 1982, and for city mayors in 1986. Meanwhile urban problems were managed by a strictly technical approach, 'avoiding' any political compromise. Within Belém, drainage works began during the 1960s; inhabitants of old invasions in waterlogged areas were relocated in official settlements, built beyond the institutional belt on public land that was still available, while up-graded areas were taken over by the formal land market and occupied by high rise buildings (Trindade, 1998:66-68).

During the 1980s, opposition between invaders and landowners was already clear. It was a decade of conflicts, favoured by the political 'opening up', which was happening on a nation-wide level and allowed struggles against repression. Police were called to remove settlers of invaded areas, usually owned by institutions, while invaders organised themselves in representative associations with the support of the Catholic church and of several professional organisations (of lawyers, architects, social workers, sociologists, etc.). The built space of invasions was considered

provisional by local authorities. Reallocation of invaders to further firm land was seen as the best solution, despite clear disadvantages to invaders in term of distance and access to jobs and urban services (fieldwork:2000).

Over these years invaders have worked as carriers, maids, street vendors, bricklayers, carpenters, housekeepers, etc, and modified their environment, providing layers of landfill in public areas, in early times with seeds and palm trunks, and during the 1980s with rubbish (fieldwork,2000). When transformations were almost concluded, the new generation of politicians offered public works in exchange for votes. The main struggle was about tenure, while other concerns (environmental, spatial and even social, since an informal speculative land market was also established) were forgotten (Alcantara, 1989:25, Nassar, interview: Jan.,2000). There was no specific technical support for the creation of these new infill lands, since planning and design activities were meant to produce official settlements, located beyond the institutional belt, according to national housing policies. During the 1980s and 1990s many private settlements followed the building of official settlements and site-and-services within the city expansion area. This kind of action lacked a city-wide strategy, and prompted an invasion process between these public and private developments onto private land, characterised by organisations (invaders are registered by an informal developer and squatter settlements are built overnight), and by their smaller scale, compared with the oldest invasions.

During the 1980s the state government upgraded informal settlements in the expansion area, and to the present has carried out big works of drainage in the first league, which has upgraded basins located westwards of the city (Fig. 3.7). Local government has benefited from the 1988 Constitution's decentralisation orientation, receiving much more power and funding, and has created new offices and established partnerships to provide affordable housing for low income people. It has also accessed international loans to carry out drainage works in another basin located within the city centre. However, the political scene is marked by political rivalries between the state and local governments that prevent any partnership between the two levels of power. During the 1980s the newly democratic state government motivated invasions to increase votes and perpetuate itself in power. At present the local mayor, elected by the Labour Party, also has adopted a populist attitude, even though presumably motivated by different ideas. The party's wish is to run what should be the people's government (fieldwork, 2000).

Fig 3.7. View of a street before and after the macrodrainage works in Una basin, located westwards of the city. Source: Pará State Government, 1998/1999.

3.4. Summary and conclusions

This chapter started by explaining the character that cities have assumed in the new world economic order, and points to the heterogeneity of the process of urbanisation in developing countries. Requirements of infrastructure provision are increasing while financial resource and management conditions are decreasing, resulting in the reinforcement of the inequalities already present in developing countries.

Historically, a developing countries' government have represented the interest of middle and upper classes and conceded benefits to the poor in order to legitimate their power. All too often, low income housing provision is taken as a political rather than a technical issue. Informal settlements are recognised as necessary and allowed to develop. They offer: opportunity of political legitimacy to elite representatives (government and politicians); maintenance of the status quo, avoiding demands for change in the economic and social system (cheap houses, reinforcement of low wages, cheap labour costs) and reassure the principle of private property. Conversely, they are the result of the poor's understanding of political deals during electoral times; of fragmented approaches to the housing issue; and the actual impossibility of adopting plans as an effective instrument of management, and are associated with the action of several different agents.

This process keeps the third world economy working; however, it has some adverse local and macroeconomic side-effects. At least 40% of the economically active urban population of third world countries either live or work informally. Their low wages help production but prevent consumption, and the concentration of resources in upper and middle income groups is physically expressed by the equivalent concentration of infrastructure in the areas in which they live in the cities.

Observation of infrastructure provision levels is one of the best indicators for assessing informal settlements' level of consolidation and integration into the formal city. The process of consolidation

consists of gradual improvement of houses and public spaces, according to availability of money and bargains with politicians and local agencies respectively; it usually opens up alternative strategies to increase family income, such as room renting and opening of shops in the front room.

From this, it is possible to say that Belém is a city weakly connected to the global network. It is a metropolis in a development frontier region, the north of Brazil, that has been historically affected by the Brazilian model of industrialisation, which concentrated wealth and political power in the South-eastern region. Belém's urbanisation process has also been marked by social and economic inequalities, and followed typical third world city patterns. The city has elegant districts in a well served city centre, not far from districts originating as squatter settlements.

Inhabitants of invaded areas in Belém found well-located flood plains, useless to the formal land market, as an available place to settle down. They gradually upgraded them through a convenient informal relationship with the city. These occupations have been hybrid; squatter settlement, pirate settlements and family-by-family occupations have coexisted, covering big areas within the city centre (equivalent to many present districts), and filling small gaps between existing settlements within the expansion area, usually with a configuration very responsive to inhabitants' needs.

This research cannot explain how consolidation works in wide terms, but recognises that it has happened in Belém over time. It uses consolidation stages to differentiate the informal settlements investigated in this research. The process of generation of informal settlements is richly described by the existing literature on third world cities, poverty and development, although most of the current perspectives focus on policies to tackle the problem of low income housing shortage in an increasingly urbanised world, and on environmental effects and social consequences of poverty. The consolidation process is a recognised phenomenon and its motivations are analysed, but there is still little research into the characteristics of the resultant urban form. Observation of how the urban form contributes to inhabitants' life chances enhancement and therefore to the consolidation process is central to this research, and is the focus of the next chapter.

Chapter 4
Space as a Means to Achieve Life Chances

Chapter 4 Space as a means to achieve life chances

4.1. Introduction

This chapter explains the gap that this research aims to fill. It develops a spatial dimension to life chances, and selects methodological tools to assess life chances through the spatial equivalent of their constitutive elements: entitlements, provision and ligatures. This is in order to analyse the contribution of informal settlement space to its inhabitants' life chances.

4.2. The spatial dimension of life chances

The informal process of low income housing production occurs in a fragmented fashion, through the cumulative action of several agents, ranging from informal developers, to inhabitants, to the government. It usually relies on a quite flexible relationship with time, without a hurry to meet the requirements of urban infrastructure and service provision. It compromises with formal technical and legal standards or previous quantification of land use and density of occupation. It differs from official actions of housing production which search for affordable locations, need to meet conventional infrastructure requirements at the outset, and are programmed according to previously established standards of occupation and technical paradigms.

Like many other developing countries, republican Brazil adopted the positivist perspective of progress achieved through order, during the 20th century (Bicca, 1985). It prompted the attachment of architectural and urban issues to the modernist paradigm, culminating with the construction of Brasília. The disillusionment caused by Brasilia's and its satellite cities' failures to overcome inhabitants' socio-economic differences through city design (see Paviani, 1985) during the 1970s and 1980s, added to the world-wide rise of urban planning approaches (Hall, 1988), and replaced the practice of setting out plans of alignment and urban design by plans of mass (the latter usually detached from existing site and occupation conditions). Conversely, the modernist experience has created a tradition of tackling the housing issue from the top, without effective consideration of consequences for the increase in spatial segregation on course within cities (Tachsner,1995; Pugh,1995). Scholars from different fields concerned with development and low income housing have explained the structural factors of developing country housing problems, as presented in Chapter 3. They have a good deal of information about land tenure, environment, urban growth and poverty, but, due to the need to consider local physical, climatic, cultural and socio-economic specificities, further research is needed about the role that the informally produced space plays in housing provision.

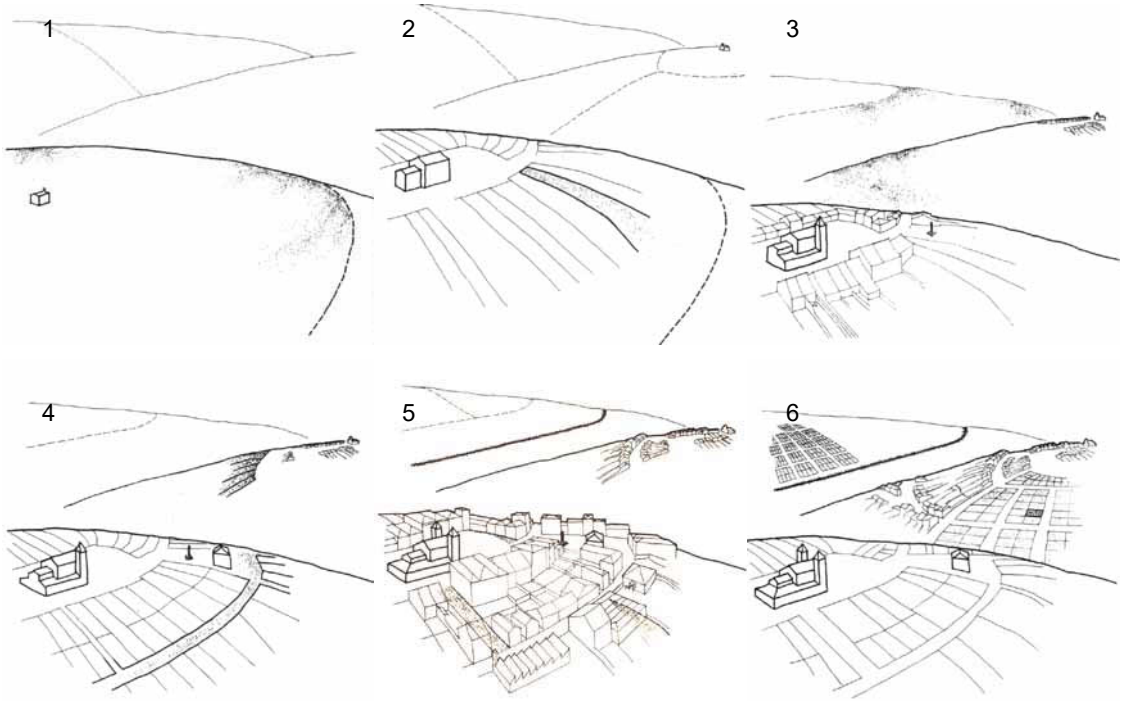


Fig 4.1. Sequence of Brazilian historic cities' development: 1) The church and its estate. The latter contributes to the church livelihood and gives it access to land. 2) The church accepts inhabitants in portions of its state. It is a tool of urbanization and an agent to transform landscape. 3) Already a prosperous 'freguesia' (community of devotees), it grows to be a village and receives a public area, the 'rossio' (a large public square) marked out by a column (the 'pelourinho') located at the middle of the square. 4) The 'pelourinho' is a symbol of city autonomy, and the city hall is built to govern the municipality. 5) The village grows and density is intensified. The importance of all kinds of borders increases and alignment issues are multiplied. 6) Raise of the real estate developer who divides a portion of the land, sells its parts and outlines the city. Source of drawings and text: Marx (1991: 42-44,78-79,110-111).

Brazilian official institutions, following the frequent pattern of developing countries' urban mismanagement, have not succeeded in wrestling with Brazil's historic tradition of occupation prior to tenure regularization and of gradual (non-planned) expansion of urban areas (Fig 4.1) (Marx, 1991)[1]. This tradition favoured the production of informal settlements, which are increasingly shaping cities' expansion. Little is known about how much the informal origin (see Section 3.2.2) of consolidated low income areas interferes with their integration into the whole city, and about the contribution of formerly informal space to its inhabitants' life chances over time, as the transformations of consolidation take place.

[1] According to Murillo Marx (1991) the first stage of a historic Brazilian city was the 'freguesia' (group of houses around a small church), which grew into a village (a bigger settlement with a public square where the church and the city hall was located). The village had its own estate and autonomy, and, depending on its economic development, it was promoted into a town, expanded or organized according to a plan of streets and cross-streets, forming a deformed grid.

Therefore, this chapter seeks for a method to accurately describe and analyse settlements' pattern of formation and development over time, through intensification of occupation. Informal settlements have often been considered 'chaotic' in relation to conventional architectural paradigms of order and harmony, indicating the need for more appropriate approaches to investigate these settlements spatial form. Urban morphological approaches' appropriateness to investigate underlying structures as much as visible forms of urban growth and change (see Box 4.1) was the reason for their usage to asses a spatial dimension of life chances, supplemented by elements of the planning discipline, and by investigation of a site's natural attributes.

Box 4.1. Background to urban morphology

The schools of morphology were created in developed countries within the fields of geography and architecture as reactions against the application of the modernist paradigms in the reconstruction of the post war city. Their initial approaches varied according to the country and the foremost concern. In Britain and Germany, geographers have developed a descriptive approach, whereas architects developed a prescriptive approach in Italy, and a design critique in France (Samuels, 1985:1; Moudon, 1997:8).

These schools were strongly affected by the orientation of European conservation policies. For instance, in Britain, where planning policies successfully froze many historic centres and isolated them from the growing city, the concept of urban morphology received less attention by professionals than in Italy, where historic centres have evolved, maintaining a continuity of urban tissue characteristics (Samuels, 1985: 4). French and German geographers created the concept of urban morphology, but Italians have always been moved by architectural interest in urban morphology, aiming at design application, launched by the seminal approaches of Muratori and Samona (Samuels, 1985: 4). Muratori's legacy was continued by Caniggia and his collaborators, and the Italian influence was reinforced later by the success and diffusion of Rossi's and Aymonino's interest in the historic city. It must be noticed that these latter authors rejected urban morphology, highlighting its tendency to promote outdated solutions to present urban problems and its incapacity to deal with situations involving modern architecture (Moudon, 1997:6).

In Britain, the seminal researcher was Conzen, a German geographer who migrated to England to study and practice urban planning, and ended by teaching geography. He initiated an inductive and empirical method of work which uses urban morphology as a tool to 'read' the city through understanding urban form, referenced by social, economic and demographic changes (Samuels, 1985:7). For Conzen, this was the possible contribution of urban morphology, because, in his opinion, there was no theoretical framework able to support planning practice, (Conzen 1973 in Whitehand 1986 p 76, quoted in Samuels 1985: 8). Conzen's legacy was continued and developed by Whitehand's work (Moudon,1997:4).

The French school began during the 1960s with the foundation of the School of Architecture of Versailles in a moment of effervescent discussion about urban life, enriched by the criticisms of the sociologist Henri Lefebvre and the architectural historians Francoise Boudon and André Chastel (Moudon, 1997:5). The architects

Panerai and Castex took an explanatory approach, successfully tracing the roots of modernism in urban design back to the eighteenth century (Moudon, 1997:8).

The approaches of urban morphology directed to design were intended to help planners and architects in decision-making about future changes to the urban fabric, and in justifying to clients proposals of intervention in existing areas (Samuels, 1985:8). Approaches vary from the extreme position of search for mimeses to the attempt to unveil underlying systems that might be respected or extended in new projects (Walker in Gosling 1984 p 49, quoted in Samuels, 1985:8). They established the inversion of the modern movement paradigm of generating space from a 'programme' to space generation through investigation of a site's present and former context (ibid.). Function is no longer the determinant of built typologies, and geographers' researches into cycles of spatial change following socio-economic transformations, and into degrees of resistance of buildings, plots and street patterns to changes over time, have given support to this shift of paradigm.

Besides all that, in Anglo-Saxon thought the rediscovery of traditional city virtues by critics such as Jacobs and Newman during the 1960s, has shifted the dominant interest of urban design practice from townscape and city image, based on the work of Cullen and Lynch, to social fragmentation and spatial hierarchies, manifested by Hillier, although no new model of the trend to return to the past was offered. Macroeconomic changes and the establishment of new modes of living and working, less dependent on zone segregation (shift from heavy industry to services and commercial activities) have also drawn attention to the potential of traditional urban blocks to adapt to changing patterns of activities. Bentley *et al.* (1985) highlighted the importance of the various agents taking part in urban development in achieving space responsiveness (taken by them to be the chief goal of urban design), through agents' action recognition and their incorporation into the design process (ibid.:7).

4.2.1. Urban morphology in squatter settlements

Studies of the physical form of informal settlements are scarce, and usually focused on plot dimension in order to investigate tenure ownership and density relationships with physical form. For instance, Payne's (1977) case study carried out in Delhi had its physical analysis concentrated on the plot, in order to identify typologies related to tenure ownership, amount of space per land use, and efficiency ratios (between settlements' public space and space appropriated by the community and number of units). Other examples are provided by Correa's (1985) and Doshi's (Curtis, 1988; Steele, 1998) investigations. Correa discussed plot arrangements and building typologies aiming to achieve different scales of common space (from small courtyards to the street), and densities responsive to the climatic and socio-economic Indian environments, and were applied in Belapur, New Bombay. Doshi carried out research on informal settlement space through the Vastu-Shipa Foundation, during the 1980s, and applied the findings to the Aranya housing project in Ahmedabad (Bhatt & Scriver, 1990).

The Indian experience is a particular example of investigation of informal settlement space as a means to enhance official settlements' spatial qualities. But evidence of gentrification in the new building schemes diminished the stimulus to further research (ibid.). The focus point was the production of housing through new settlements, although Payne (1977) and Correa (1985) recognised that the problem in the developing countries is not of insufficient housing (the poor always succeed in producing housing), but of precarious integration of informal settlements into the existing city. This is the point from where this research starts.

Within this research it is not possible to discuss the traditional themes of urban morphological approaches, such as the study of historical forms, preservation strategies or outdated spatial solutions. The urban form analysed here has been either recently generated or is in a clear process of transformation, shaped according to the socio-economic conditions of space's most active producer, the land invasion inhabitant.

Most typologies of low-income informal settlements are constituted by the same fundamental physical elements of urban form as any formal space: buildings and their related open spaces, plots, and streets. These settlements also have an urban form, which can be observed on several scales of interface (such as building/plot, street/block, district/city), and are in continuous transformation. They thus enable the basic principles of all morphological approaches to understanding a city or town through its physical urban form to be used (Moudon,1997:7).

According to Moudon (1997) it is possible to assess patterns of density and land use over time, and to understand the socio-economic conditions of a settlement's origins, by analysing the combination of basic components of urban form, according to different resolutions and over a selected period of time. Physical elements evolve diversely from city to city and even within a city, according to the socio-economic and cultural profile of successive users. This evolution creates cycles of transformation, which are able to show rates of functional (related to activities) and physical change, correspondent to the city's economic and cultural conditions.

The informal settlements studied in this thesis are usually hybrid typologies composed of combinations of squatter settlements, pirate settlements and family-by-family occupations. Over a period they are usually upgraded, receiving social (education and health care facilities) and physical infrastructure (water supply, sanitation facilities, drainage, urban roads and solid disposal facilities), and transformed into low income districts, completing the cycle of consolidation, as shown in Chapter 3. In this thesis, such physical change is associated with the inhabitants' life-chances enhancement over the correspondent period. This was measured through data about inhabitants'

socio-economic conditions and perceptions of improvement to the present, as explained in Chapter 5.

It is not possible to adopt fully the traditional research method used by morphology schools, because there are no series of data available about each particular case study area to allow study of its development over time. What is possible is to benefit from existing similarities among the processes of occupation in each case study, arising from their common physical or socio- economic context, in order to compare their different stages of evolution and to extract findings, possibly elucidative of them all. This may be achieved, for instance, by unveiling more precise differences and similarities between settlements, or by allowing identification of essential variables by observation of their urban form.

The spatial assessment of entitlement, provision and ligatures is always based on the relationship of streets with the other elements of the urban form, because they are the most stable and prevalent element in these areas. Over cycles of urban change, streets are the first spatial elements of urban occupation, providing access to plots and defining blocks through their subdivisions. They are intermediaries between private and collective scales and aggregate investments in ownership and infrastructure that make them more resistant to change than plots and buildings. In formal contexts, plots have a legal definition in maps, which safeguard their longevity; however, they are objects of subdivision and amalgamation according to market conditions and interests. Buildings, in their turn, might be replaced or refurbished many times over the life-cycle of a plot, since they depend basically on the level of control the owner has over his/her plot, and on the amount of resources available (Cannigia & Maffei, 1995; Brand, 1997; McGlynn, tutorial 2002a).

Despite the risk of isolating the different dimensions of investigation from each other too much, spatial entitlements are best observed through the potential to displacement within a city offered by the urban fabric, particularly the street layout. Spatial provision is constituted by the arrangement of streets, blocks, plots and buildings and by infrastructure. Spatial ligatures are observed through watching the use of public spaces. The particular approach to each of these elements was chosen according to its capacity to express space's complexity by encapsulating, for instance, considerations of global and local scales, public and private dimensions, and of space and society. It is important to recognize the continuum between these extremes to minimize inappropriate clinging to outdated static positions, and the risk of losing the dynamic of observed process (Arida, 1998).

4.2.2. Space and entitlements

Architectural research has demonstrated that space is neither the determinant of, nor neutral to, society; instead it shapes possibilities (Hillier,1996:206). Then, if *entitlement* is defined as a *socially acceptable means of access to desired goals*, it must have a spatial dimension. In theory, international agreements about human rights and national constitutions are recognised by local laws and respected as a legal guarantee of inhabitants' basic rights. However, within the reality of a developing country city, the uneven process of urbanisation differentiates space and access conditions to, for instance, housing, schools and health care, in quantitative (availability) and qualitative (reliability) terms.

Socio-economic constraints on the realisation of basic human rights (e.g.: rights of access to shelter, education, income and health care) are evident within the developing country city to the extent to which its low income inhabitants are dependent on informal housing and the informal economy (Hall, 1987:251). Physical access to and availability of land are crucial for those who decide to settle in the city for whatever reason; the absence of policies to deliver land prior to its occupation, and the high costs of the formal market, determine low income inhabitants' choice (Payne, 1999). The poorer this population, the more it needs good accessibility, preferably location near to the city centre. In order to accomplish that, the poor 'search' for flooded or prone-to-slide land, the 'unsuitable' land which has been avoided by the formal market, in the adjacencies of urban centres, in which to settle themselves (Hardoy & Satterthwaite, 1987: 306).

Despite many technological changes in the Western city's way of life, the informal settlements' inhabitants still seek for basic urban services and facilities, and need to benefit from short distances, highly used spaces and superimposition of activities. Ironically, it is already clear from the background, set out in Chapter 3, that these inhabitants' low incomes push them down to unsuitable sites, which, when recently occupied, usually are among the most segregated and deepest spaces within the city. However, the weak connection of informal settlements to the formal city, or to its subcentres, may be just temporary, depending on restrictions imposed by the site's physical conditions, which may be transformable over time, and the capacity of a new grid to be embedded in the existing one (Hillier *et al*., 2000). This allows the creation of more connections and a better potential for entitlements and justifies the adoption of space syntax techniques as tool to assess spatial entitlements in this research.

Access to a place or plot through a street is considered here as the first element of spatial entitlement. It is not a surprise that regular street patterns or urban grids outlast centuries as spatial solutions in new settlements. Hillier (1996:179) defines streets as the 'first powerful theorem of

urban engineering', due to the facility of enhancing efficiency of movement within a city which they create. The street system is transformed into a mechanism to generate contact, by using each pedestrian's origin-destination trip as an opportunity to create more encounters and contact than the user previously intended. However, even urban grids are usually differentiated according to locational variables. In colonial Brazilian cities, for instance, such differentiation used to be caused by a major square where the cathedral and the city hall were located, and by the port or road location, according to the case (Marx, 1991; Lemos, 1979).

The process of industrialisation and much faster urban growth has increased the importance of location. Within developing country cities, such as Belém, the scarcity of means to provide the same standards of infrastructure over the entire city's street system has caused further concentration of activities and investment in central areas. It has strongly affected patterns of density and land use, and accentuated qualitative differences between centre and periphery (Lima, 2000). Conversely, the developed country's city also tends to specialise its space by creating discontinuity within its grid through enclaves or restrictions on multifunctionality, favouring city sprawl, fragmentation and precinctisation.

In both cases the urban grid becomes 'a means to accelerate movement in order to overcome size' (Hillier, 1996:179), causing the replacement of loose movement over many alternative combinations of routes by origin-destination movement. This shift has affected entitlement conditions in terms of physical distance to desired public services and to sources of income, such as domestic employment in middle and upper class household or unskilled jobs. Excessive hierarchy within a city and/or urban fragmentation have also caused a reduction in the economic potential generated by pedestrian movement along streets. Areas either sparsely occupied or highly segregated prevent low income inhabitants from earning their living through street vending, or from using the home as a shop or office, and increase dependency on public transport by those who are already poorly served (Hillier *et al*.; 2000).

In spatial terms, the economic potential of pedestrian movement is historically related to the structure of the urban grid and to its patterns of densities and land uses. This means that under certain conditions of density and integration of a grid, things can happen that will not happen elsewhere (Hillier, 1996: 170). The good space is the used space, the most frequent use of space is movement, and movement is a by-product of the choices offered by a grid for getting from one place to any other place (through all possible routes available by a city's street combination). The informal use of space is strongly pedestrian-movement-related, as is the sense of urban safety (ibid.:170). In Hillier's opinion the urban grid is the primary source of life in cities, because of its

capacity to favour mixed activities. He states that land use and density follow movement in the grid, adapting to it and multiplying its effects (ibid.).

In physical terms, structure can be a property opposed to order. Order is made up of similar parts arranged through similar relations. It is best achieved when built up or imposed all at once (ibid.:235). Deformed grids, which do not have enough repetition of elements and relationships to create such an order, usually have a strong structure: spatial patterns that neither can be seen at once nor are imposed at once. These grids are asynchronous both in their genesis and in the way one experiences them (ibid.:235), although they are made intelligible by the process of living, and, more importantly, moving in a town, according to Lynch (1960), through landmarks and affective associations.

The informal settlement's space is mostly asynchronous, and hardly makes sense to those who do not live in it. This fact prompts its classification as a disordered space. Nevertheless, both order and structure exist in the 'abstract' space and in the 'built' form, but order is natural to form, or to what is built synchronously, and structure is natural to space, or to what is formed asynchronously (trough independent and non-coordinated actions). With these differences in mind, it is easier to understand why up-grade solutions to informally produced spaces should not be compromised by formal standards and should be negotiated with the user community. The existing structure must be considered and assessed to avoid arbitrary imposition of simplifying order.

For this reason, observation of the relationship between local and global scales of accessibility, and of the potential of movement within existing street layouts, is used here as a means of assessing the condition of entitlement of informal settlement inhabitants. Streets, like classical legal entitlements, may be either obstructed or connected (rights are either suspended or given) to the city grid, either restricting or improving access of users to desired activities. This varies according to the social practices and governance policies adopted in the city over time.

4.2.2.1. Means of measuring physical accessibility

The literature on models for understanding and predicting movement also acknowledges that, before the industrial age, a traditional city had its structure determined by economic exchange and social interactions based on walking (Batty, 2001:321). The old city scale was very responsive to how far people could walk, and existing patterns of land use were determined by distance. This literature also highlights the importance of distance as the principal independent factor in pedestrian movement, because of its determinant effect on travel time (Salheen & Forsyth, 2001). Trip type, trip purpose, age and sex, geographic location (taken to include land use patterns and topography), time of day, available facilities for motorised displacement, weather and climate given conditions are

presented as relevant variables in determining acceptable walking distances (Senevirate, 1985, quoted in Salheen & Forsyth, 2001: 98; Salheen & Forsyth,2001).

Since the development of transport planning during the 1950s, pedestrian movement has been disregarded, because of the strong bias of models towards understanding and predicting movement of private motorised transport on a greater scale than that of walking, and the adoption of analyses based on origin and destination and large transport zones. The computerised models of transport (and land-use) were designed to produce accurate forecasts of origin-destination movement, and to be based on majority profiles of the population, incompatible with the fine scale associated with pedestrian movement (Batty,2001:321).

At present, pedestrian movement is taken into account to simulate impact on vehicular movement rather than for its own prediction. The analyses of pedestrian movement in cities in transport planning are not well developed, and the new contributions are largely divided into the geometry of movement, location of movement groups and the accessibility approach (ibid.). Batty says that 'accessibility is usually defined as the potential for spatial interaction at a point or node or location in the system, and is formed by summing potential interaction around any location with respect to all others' (ibid.:323). In Hillier's 'space syntax' theory, streets are considered as nodes, and the accessibility of a street is called its 'integration', which is correlated with pedestrian movement (ibid.). Despite criticisms that it cannot account for locational determinants, this may prove to be a low cost model for predicting pedestrian movement and land use potentials (Batty, 2001; Salheen & Forsyth, 2001).

Space syntax is an exploratory technique to find either problems or potential in the urban structure, rather than to offer solutions or to give definite results (Hillier, 1998; quoted in Salheen & Forsyth, 2001: 96). It evaluates the potential for physical accessibility and helps the understanding of social patterns which arise in those spatial structures by using an axial map to represent the topological relations of visibility and permeability of a space. The axial map is drawn through the insertion of the fewest and longest straight lines of sight and access into all circulation routes, wherein each line represents how far one can see and move from a space. Space syntax assumes that pedestrians decide their route according to the minimum number of changes of direction they must perform to move from one space to another (Hillier & Hanson, 1984; 1998).

Each change of direction is called a step, and the number of steps of a system defines its depth or shallowness. Integration is the mathematical measurement of the relative depth or shallowness of one line in relation to all others in the system. This is the most important syntactic measurement, and can be calculated from a determined point within or outside the system. When accessibility to

all lines of the system is taken into account, this is called global integration; but when the measurement is restricted to the access from one line to three or some other established quantity of lines, it is called local integration. Global integration characterises accessibility of the whole system, while local integration works with portions of the system, being more related to pedestrian levels of accessibility than to the wider whole (Hillier & Hanson, 1984; Hillier, 1996).

Space syntax benefits from the urban systems' relationship between lines (streets and roads) and built form to be reached through them. When there is correspondence between expansion of streets and addition of built forms, line length is proportional to built occupation. Line length also provides indications about connectivity (number of intersections of a line). The incorporation of the topological measure of integration by the axial lines associates the lines' capacity to attract movement to the built configuration. Therefore, patterns of unequal attraction within the urban system reflect inequalities in line length and connection (Hillier & Hanson, 1998).

The correlation between global and local measurements (e.g.: global integration versus local integration, or control, or connectivity) is called the intelligibility of a system; it expresses the quality of space in providing understanding to people about the global structure of its street system from information received about the space they are in, or how far it is possible to capture an idea about the whole from the experience of one of its parts (Hillier, 1989:63). Values of intelligibility tending to 0 reflect a labyrinthine structure, and values tending to 1 express excessive regularity. Typical urban areas present a correlation around 0.45 (Holanda, 1997:87).

The explanation in Box 4.2 shows some techniques that have inspired the assessment of spatial entitlement in this thesis.

Box 4.2. Exploring accessibility through centrality

The gradients of accessibility potential within a grid are an expression of its centrality. Hillier (1999:108-109) takes the traditional city characteristics as the starting point for defining centrality as a process; he says that, in small traditional cities, centrality arises from the correspondence of a focal 'live centre' and the market and retail area. When time is incorporated into the description, it is possible to see that centrality has no clear limit nor permanent focus. There are cases in which the centre remains with the same focus and spatial characteristics over long periods of time, but conversely, it may evolve, or move from a historical area towards an edge. The shift of central areas over time, in the process of city growth, creates the hierarchy of centres and subcentres which form the urban structure, 'ranging from the large local centres which can rival or even outstrip the main centre in levels of activity, down to the small groups of shops and other facilities that act as focal points for focal areas' (ibid.:109). At all its levels, hierarchy also shifts to the extent that centres grow and fade as answers to changes that may happen at further points of the city.

Because of both spatial and functional dimensions of centrality, Hillier (1999) claims that it is essential to assess centrality through understanding how its changing states are generated by continuous spatio-functional processes, instead of simply describing these states and facing the risk of mistaking what is transitory for what is permanent. In order to do so, Hillier (1999) proposes the principle of the 'movement economy', saying that centrality would be better understood through a model that associates structure and activities (function), to better explore and demonstrate the relationship between them and show how both structure and activities are driven by social and economic activity.

Hillier (1999) introduces several methods to detect the process of the movement economy by searching for spatial justifications for the existence of established subcentres, which are not always noticed in traditional space syntax analyses. His first method (see Fig 4.2 and 4.3) showed that, despite the existence of similar values of global integration in the streets of an area, there is more movement and mixed activities where a larger number of smaller blocks (with more building entrances feeding public space) form more intensive grids. His second method did not present such an intense grid, but showed a line distinguished from its surrounding area by being the only line to traverses the whole system, joining together local grids which were otherwise relatively distinct. This allowed the formation of a more complete local grid that can be better 'seen' from that central line (the more frequented street) than from any other line in the system.

A third method measures the scale of a centre through statistical correlation between the number of existing shops and services along its streets and the existing syntactic values, showing that local grid conditions appear the main variables conditioning the degree of centrality, followed by global integration. The fourth method studies how a multifunctional area moves from a linear towards a convex form. Within the most commercial area of a route which crosses a city from edge to centre and out the other side, short lines define a larger number of blocks than anywhere else, and blocks are smaller there than elsewhere, with forms that maximise perimeter (approximately square, tending to a circle). The fifth method makes a comparison between several cities and shows that global and local integration values, and the correlation between the two, all increase gradually towards the city centre, reach a peak there and reduce gradually towards the edge.

To demonstrate that space syntax copes with distance by incorporating it, Hillier uses the following assumptions: a) 'town centres can be defined as complexes of interdependent facilities, so that if you come to use one, it is easy to use others' (ibid.:122): b) there are two kinds of movement that influence the evolution of large scale urban grids - linear movement, from specific origin to specific destinations, which defines quasi-linear sequences, and moving around, which happens in a quasi-grid sequence, and is essentially convex in form (ibid.:122). This second kind of movement maximises the integration that accounts for distance in two dimensions, and minimises trip length from all points to all others within a two dimensional zone, which is the centre of the settlement, or a city subcentre.

The location of an urban centre or subcentre is defined by the city's structure of linear movement. The linear system formed by streets provides the connections to the compact and two-dimensional central area. The latter is a product of the 'movement economy process' within the area formed by the selected lines of the one-dimensional structure (Hillier, 1999:123). Hence, centrality is understood as a process (of formation of central

locations) driven by minimization of distance in both one and two dimensions, and through this assumption attraction and configuration can be unified.

As a test, Hillier creates an experiment to evaluate the metric integration of different configurations generated with the same amount of unitary distance (represented by a dot). A fine tessellation was created, and its elements were treated as the nodes of a graph. Several combinations of dots, forming lines, were created and evaluated, and the most striking results were found when the number of lines was kept the same and only the distance between them was modified. Larger central blocks decrease integration, and small central blocks increase it, as predicted by the centrality principle (ibid.:125). Furthermore, when four different combinations were assembled as a unique system, the new integration values followed those of the separated grids, confirming that '(other things being equal) a more integrated subcomplex will act as an overall attractor in any system of which it is part' (ibid.: 125) (Fig.4.4).

This acknowledges distance, through metric integration, as determinant of centrality at any level, and demonstrates a theoretical relation between attraction and configuration, even though it assesses attraction through indirect evidence. It is a strong indicator that attraction inequalities produced by the movement economy might be characterised by spatial patterns, confirming the contribution of space to entitlement conditions.

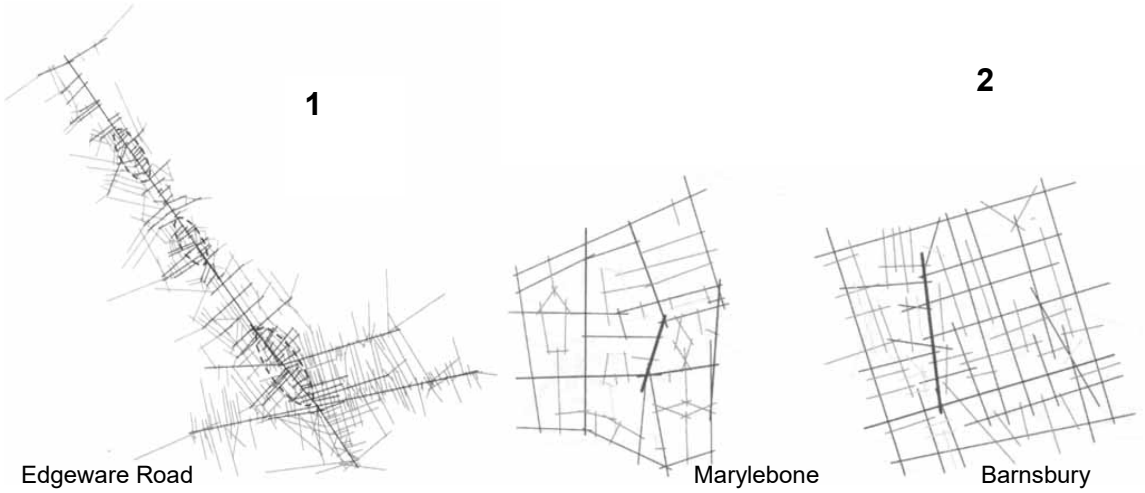


Fig 4.2. Different techniques to explore centrality. 1 – First method. The darkest line is Edgeware Road, next darkest are all the lines intersecting the former, and the lightest lines are intersecting those (Hillier, 1999.:112). 2 – Second method. Integration analysis of Marylebone and Barnsbury areas (ibid.:113).

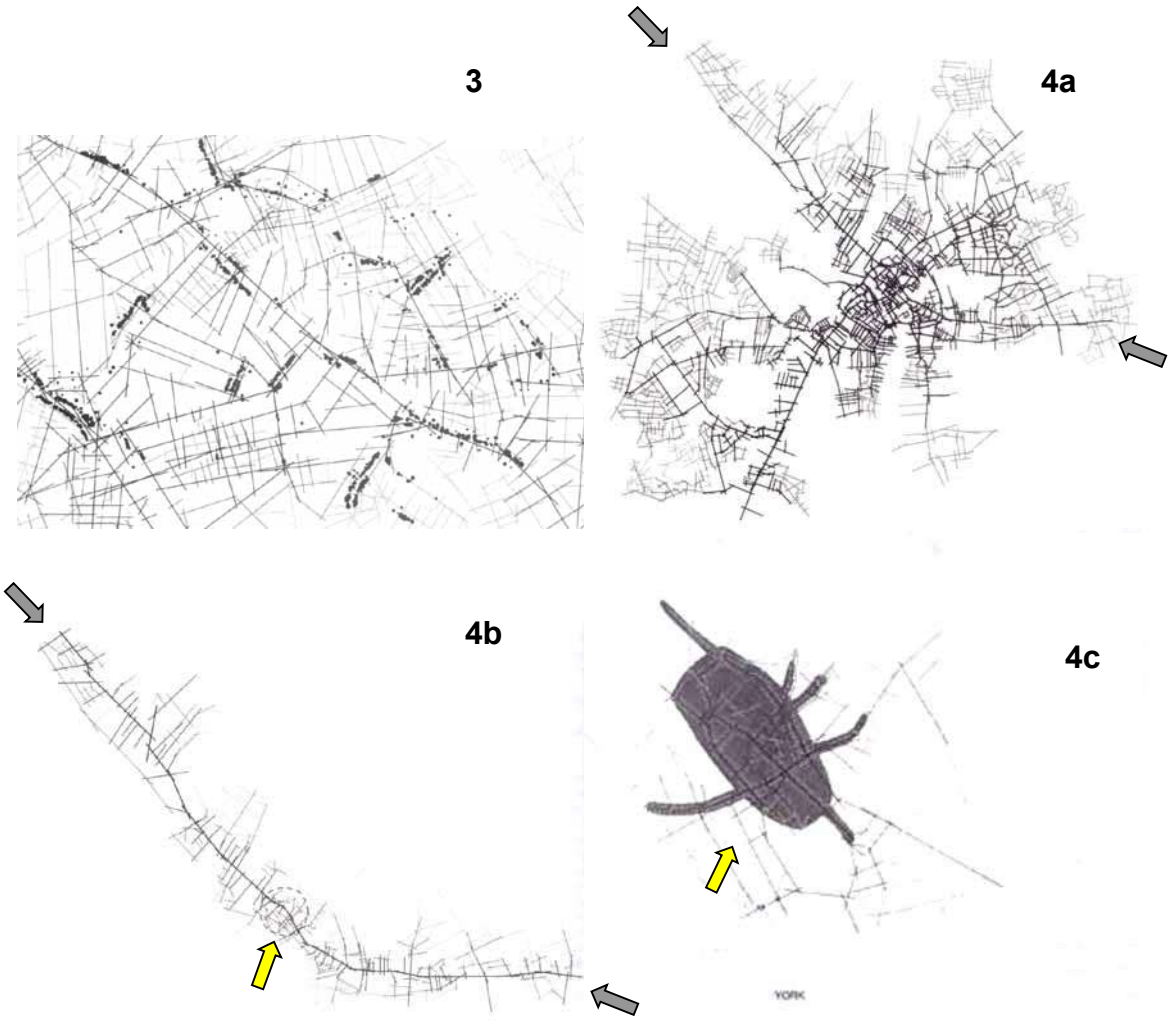


Fig 4.3. Different techniques to explore centrality. 3 – Third method. Camden shops (ibid.:115)
4 – Fourth method. 4a integration map of York (ibid.:117); 4b transect analysis of York (grid pattern created by up to three steps away from a through route in York) (ibid.: 118); 4c live centre of York (integration analysis and the main retail streets of the central grid) (ibid.:119)

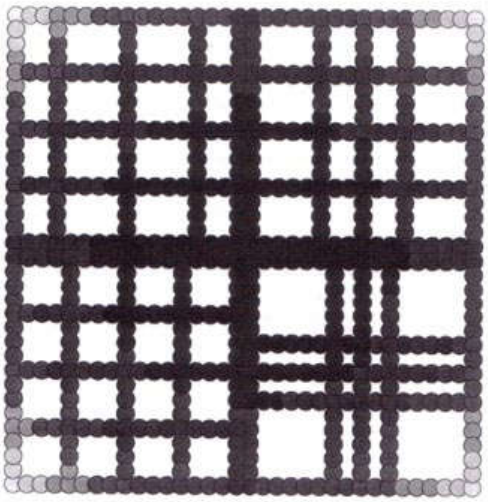


Fig 4.4. Effect of distance in different configurations. When four grids are combined into a single system, integration is attracted into the individually most integrated system, the one with smaller central blocks. Values of integration are higher in the lightest gray dots; top left: 0.070970, top right: 0.070397, bottom left: 0.070684, bottom right: 0.070111. Source: Hillier, 1999:126)

4.2.3. Space and provision

Every physical activity (in the sense of involving human bodies) needs a place to happen, a piece of ground which is differentiated from the natural landscape by its cultural use (Tuan, 1983; Holanda, 1997). Hence, space as provision develops through the transformation of natural into built environment, through human agency and according to available resources.

The urbanisation of natural space was speeded up in Brazil after the 1950s, through the incorporation of capitalist relations of production into the process of urbanisation and city expansion (Santos, 1980). Landowners, entrepreneurs, funders, big companies that buy and develop land, all had particular interests in this process, which led to the repetition into the cities of the existing unbalanced relations between city and countryside and between different regions of the country. This resulted in abundant service provision in central areas and scarcity of them in peripheral areas. The best served areas became contested for by the wealthiest activities, and occupied by high rise buildings. Prices became a function of accessibility to the centre, and low income housing was feasible only on the outskirts of the city where urban facilities were minimal, and prompt solutions were based on two distinct alternatives, informal settlements and official settlements, as shown in Chapter 3. Box 4.3 presents explanations about how commodification of land happens in Brazilian cities.

As the quantity and quality of housing officially provided for the poor is insufficient and more expensive than it should be, the poor have produced space to live in, conscious of the unavoidable struggles to be faced in order to upgrade this space over time. It is a collectively and spontaneously produced space and needs to be assessed through approaches based on the idea of change. Urban morphological approaches based on empirical data (Cannigia & Maffei, 1995; Conzen, 1969), which have explained vernacular occupations in contexts with different levels of material infrastructure, may offer suitable tools to discover which elements or characteristics of the production (or provision) of informal settlement space help enhancement of inhabitants' life chances.

The investigation of the evolution of informal settlements' urban form over the time span of its formation may help understanding of how and why entitlements were given or withdrawn. As defined in the theoretical concept of life chances, provision is affected by supply conditions and is dependent on economic growth, so physical provision may qualify spatial entitlement, through the qualitative and quantitative diversity of access given to the former.

Box 4.3. Space as a means of production

As explained in Chapters 2 and 3, land is also a commodity in developing countries, a means of production subject to commercial deals and to profit. Gonzales (1985) explains that the understanding of how the yield of urban land is produced is based on analyses of traditional agricultural production in the countryside. In agriculture, prices are established according to the worst conditions of cultivatable land. This means that the price of a product is presumably always above the cost of production in the worst lands. As traditional agriculture had a low technological level, high levels of waste and poorly qualified labour, yield margins were increased to compensate for losses, which, in cases where losses do not happen, are incorporated into the average yield of urban land, as estimated by the market.

However, while agricultural production leaves rural land which become available for new production, urban land is the base for buildings that are constructed on it to produce housing. The common point between rural and urban land is private ownership; the land available to construction in the city is compared to agricultural land in the countryside. The mechanisms to transform urban land into a commodity are similar to those applied to rural land. According to Gonzales (1985), two types of differential income, one absolute income, and the monopoly income, compose land income.

The site's physical conditions and location generate the first differential income: a flooded or hilly site demands bigger investment in order to become suitable for building, but the feasibility of investment is highly dependent on potential for accessibility. Zoning laws that establish the allowance of square meters per plot generate the second differential income: the plots, which permit a higher quantity of building on the same quantity of area, increase income. Absolute income is generated by the difference between costs of production and prices paid in the market: always when the periphery is expanded through precarious settlements, the value in all other areas is increased, because prices paid in the city land market must allow income generation even on the worst land.

Monopoly income is the greatest determinant of land income levels. It is generated by the availability of infrastructure, existing conditions of accessibility and area status. Scarcity conditions and private ownership allow landowners to manipulate the state market by retaining available land, in order to achieve higher profits afterwards. This mechanism is more or less profitable according to the rhythm of the city growth; the strength of interests in question and the power landowners have to speculate by retaining land; differences of income among social groups (existing inequality in the city); and level of autonomy of the state market.

The Brazilian Constitution of 1988 introduced guidance for the establishment of urban policies that should allow democratic access to urban land and to housing. However, Federal Law No. 10,257 (called City Statute), which provides the judicial instruments required for the implementation of urban policies, was approved only on 10/07/2001. This law provides support for municipalities to control and counteract precisely the conventional mechanisms of the state market described above (Fernandes, 2001).

4.2.3.1. Urban morphology and footprints of informal settlements

According to urban morphologists, cities 'develop' themselves by changing their physical form continuously (Kropf, 2001) through the action of different agents and producers of space. The primary determinant of urban occupation is the site, but urban settlements are initially materialised through streets that connect two points: a pole (building or place that works as an urban generator) and an anti-pole. Through non-planned urbanisation, streets gradually define block shapes, according to the evolution of occupation along them. Streets also are historically differentiated; for instance, occupation starts in a primary street, prompted by a focus of interest; when a second street (street of implementation) intercepts the first, the urban fabric starts to be generated. Afterwards, streets of union connect streets of implementation (Caniggia & Maffei, 1995) (Fig 4.5). These streets may be differentiated by size and shape of plot, each presenting different levels of density, creating a hierarchy and a potential for different land uses (McGlynn, 2001, tutorial). The intensity of occupation usually increases with the proximity of the main living focus in the settlement, towards which more intense fluxes are oriented (Santos,1988).

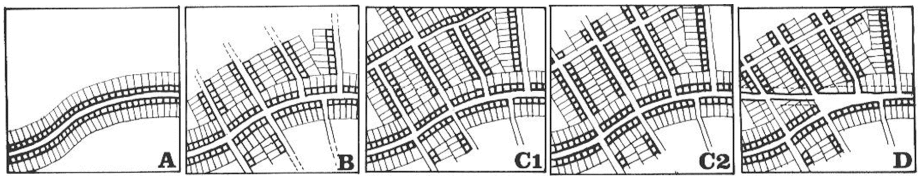


Fig 4.5. Models of urban fabric formation. A – primary streets; B – streets of implementation; C1 – streets of union generated previously to implementation streets' extension; C2 – streets of union generated after implementation streets' extension; D – street of up-grade (Cannigia & Maffei, 1995:88)

Blocks are progressively defined by each street's series of plots, which are occupied in parallel (forming a route rather than defining sides of a block). Series of plots facing each other usually have a synchronous occupation, reinforcing the importance of routes over blocks in morphological terms (Caniggia & Maffei, 1995). In regular conditions of occupation, the site is considered the most permanent of all physical elements (Brand, 1994), but in the case of flooded informal settlements it is still in a process of generation, coming after the street pattern (defined by elevated wooden walkways, called in Belém '*estivas'*). In these cases, the site is the determinant of settlement location, to the extent that sites with disadvantaged physical conditions (flooded plains, hills, hazardous areas) have occupation postponed as much as possible, and often are the only areas available to the poor. The site's physical condition also determines intensity of occupation (density) and level of upgrade investment (infrastructure provision) within the context of poverty[1].

[1] The costs of the foundations of a high rise building located on previously waterlogged areas of Belém represent 30% of the total building price. If this building were located on firm land, but still in Belém, foundations would represent a maximum of 10% of the total building price, although in another city, not located on floodplains, this percentage would drop to 5% (Interview: Cardoso, 2002).

Another type of change in urban form is through evolution, applicable to buildings and plots (Kropf, 2001). These elements evolve typologically through trial and error, as they have a smaller degree of resistance to change (Brand, 1994). The first step of this process is the reproduction of inherited forms, the second is the production of variations, and the third the reproduction of successful variations (Krop, 2001). This argument explains the similarities between buildings within an organically developed city, and may help classification of informal settlements between the extremes of a city development and of a typological variation arising from an inherited knowledge (within the local context) about how to built settlements. Furthermore, the argument provides greater security for methodological assumptions of valid comparisons between informal settlement spaces, and about whether informal settlements can be classified according to type or not.

Urban morphology often organises empirical data through cycles, periods and series. Morphological periods, for instance, are defined by Conzen (1969) as 'any period in the cultural history of an area which creates distinctive material forms in the cultural landscape to suit the particular socio-economic needs of its society. These forms survive in varying degree as residual features' (ibid.:127). These periods may correspond to cycles of building development according to conditions of land occupation and socio-economic demands and may produce belt-like zones of peripheral mixed land uses when growth becomes stationary. This research searched for a correspondence between morphological periods and consolidation cycles, in order to identify morphological clues related to different stages of consolidation.

However, the whole process of space generation is just part of spatial provision; all spaces created are expected to synchronously receive infrastructure according to existing demand and affordable technical standards. This does not happen in informal settlements, due to the usual increase of people and plot coverage density at a higher rate than infrastructure provision, aggravated by the producers' socio-economic constraints.

4.2.3.2. Density and infrastructure

The informal settlement's space is a means of survival. Inhabitants manage space's contribution to the satisfaction of basic needs. When plots are bigger, and density is lower, subsistence cultures and orchards help livelihood, and creation of own water and sanitation systems is more likely to be possible (Madaleno, 2000; Choguill,1996). When land becomes scarce, often due to lack of accessibility from non built-upon land, existing plots are subdivided and density increases. The possibility it creates of per capita costs reduction in infrastructure provision is undermined by the technological standards usually proposed to these densities. This results in delays or absence of investments due to the financial constraints of inhabitants who continue to live in, not only flooded,

but also overcrowded areas. This begins a vicious cycle of poverty, environmental degradation and health problems.

As part of a strategy of survival, informal settlements are often located on or near flood plains, rubbish dumps, and other hazardous sites where land is affordable, or in hope of benefiting from the location to raise money. This often jeopardises access to important assets such as clean water, and to sanitation and rubbish collection (Drakakis-Smith, 2000; Vieira, 1997; Acioly & Davidson, 1998). Physical (and also social) infrastructure provision is seen as a long-term prospect and is dependent on the prevailing political and technical paradigms of urban governance (Choguill, 1996).

Users are expected to pay for infrastructure provided by government, and its cost depends on established standards. Informal settlements try to benefit from accessibility to social infrastructure available nearby, but also require a proper solution to lack of physical infrastructure. When formal standards are transferred to them by upgrade actions financed by governments, the cost of this infrastructure can rise above 50% of the total site development costs (Choguill, 1995). Such schemes emphasise social and physical infrastructure provision (and might be combined with site and services when relocation of inhabitants is needed); possible new arrangements of parts of layout; tenure regularisation; and, sometimes, provision of technical or financial assistance for housing improvement (ibid.; Payne, 1984). Intermediate technology may be considered inferior to the more expensive, but has proved to be more suitable to inhabitants' income and environmental and health objectives. The choice of technology is usually a question of paradigms adopted by authorities, and related to the relationship between a community and infrastructure agencies (Choguill, 1995).

Conversely, density, within an informal context, depends on household size, land availability, settlement layout, size and shape of plots, and typology of buildings (other important variables, applicable to formal contexts, are legislation and level of infrastructure available) (Acioly & Davidson, 1998:23). Higher densities are not a problem in themselves, as very dense cities (such as Amsterdam) cope very well with high densities. There is a problem when high density constrains sustainability, which may happen when it is not followed by compatible infrastructure solutions. It can cause overcrowding, difficult access in an emergency and conflict with local climate requirements (as in hot and humid equatorial areas) (Williams *et al.*,2000; Schiller & Evans, 2000). For the sake of creating minimum street widths and better safety conditions, compulsory household relocation is common in the case of upgrading, although it has to be carefully managed because of its complex socio-economic impact on inhabitants' lives, and its potential to cause gentrification (Acioly & Davidson, 1998:24).

In the informal settlements studied in this thesis, it is suggested that priority should be given to the brown agenda, due to the high likelihood of water contamination and unhealthy living conditions in all the case study settlements. Conversely, the process of site transformation raises issues watched by the green agenda (landfill of flood plains, removal of vegetation). The object of interest here is the paradigm of infrastructure provision rather than the particular solution of water and sanitation provision; the impacts of solution on informal settlements' space is important. Moreover, healthy and safe environments on a city scale need the support of national policies, and within benefited communities any program needs to be complemented by hygiene education. Within the complexity of the informal settlement consolidation process, more attention could be given to how things are done rather than to results, according the recommendations of Williams *et al*. (2000) about how to achieve sustainable urban form. Conscious awareness of the international dimension of both agendas by those in power is also necessary to avoid the dominance of alien priorities and further reinforcement of inequalities within developing country cities (McGranahan & Satterthwaite,2000).

The next section of this chapter deals with the issue of human motivation; it offers an understanding of what determines inhabitants' choices, given the alternatives of provision open to the poor. In terms of informal settlement space, it also may help understanding of how people cope with living in waterlogged areas and of what makes them stay or move out along the stages of consolidation process.

4.2.4. Space and ligatures

According to the concept of life chances, *ligatures are the linkages between entitlements and provision* (Dahrendorf; 1979, 1988). They are defined as producing human motivation, shaped by traditional, social, cultural, psychological and other values. Ligatures give sense to choices between eligible alternatives, and have shaped space in different ways all over the world. The research approach developed in this chapter searches for a spatial dimension to each element of the concept of life chances; as the most abstract of all, ligatures is assessed here through street life, because of the latter's capacity to express relationships between space and its users, and therefore to unveil human motivations and profiles.

At present, many authors (Sennet, 1993; Soja, 1996; Castells, 2000) offer a picture of a world-wide trend which will end urban life as public life; structural inequalities have generated social unease and violence, and often lead to measures of self-protection by those who are at the top of societies. This is clearly exemplified by the extreme case of California's increasing numbers of gated communities, which expect to be 'protected' against the minorities of poor, Hispanics, blacks, and others disliked by the mainstream society.

Levitas (1991:228) claims that life in the streets, like any cultural artefact, reflects the adaptation of modern culture to the environment, and therefore changes in the technological and sociopolitical configuration of our societies are keys to understanding the present decline of street life. For instance, industrialisation and centralisation impacted on daily social life in urban spaces through automobiles, television and definition of new economic scales that made small personal business unprofitable and favoured the growth of impersonal supermarkets and shopping centres. These made division between rich and poor more extreme and increased social tension and violence on streets.

Box 4.4 presents a brief evolution of street life in Western cities, showing how streets express forms of social organisation by creating systems of barriers and permeability that help to regulate social interaction among social groups. Streets previously worked as centres of information, but became progressively specialised according to the rhythm of progress in technology and capitalism. The identification of streets with social class was expressed through their physical amenities and rhythm of occupation. The emergence of a global economy, and transformation of cities into nodes of the global network, has overemphasised the circulation and symbolic dimensions of streets. These favour centralised power and control, and indicate a trend to homogenisation of public spaces that serves the interest of upper and middle classes, but neglects the basic need of children and elders for attachment to a primary space that should be stable and predictable (Levitas, 1991; Weber, 1964).

Changes in transport and telecommunication systems are shrinking the world, and for those who are up-to-date with technology, distance has become an elastic concept (Weber, 1964). As a consequence, the social network of transpatial groups (often professionals) does not have geographical borders; for them, social networks are no longer formed in the urban environment of cafés, clubs and bars or within a neighbourhood (Knox & Pinch, 2000:221-222; Hanson, 2000). However, adaptation to a single type of environment tends to eliminate the same genetic and cultural diversity that has helped mankind to successfully adapt itself to different environmental circumstances. In nature, the simplest ecosystems are easily destroyed (Levitas, 1991:233).

Furthermore, human beings need a sense of purpose that derives from their relationship with others. If these relationships are replaced by technology and an enforced political system, human beings change from being active and inquisitive creatures into passive victims of a system. In this sense, investments in restoration of social and economic functions of primary groups and spaces, in order to encourage contact, should be considered a priority in relation to upgrades in technology (ibid.; Turner, 1997).

Box 4.4. Evolution of street life in Western cities according to Levitas, 1991

Over time, streets have been the locus of active distinction between private and public domain, where current political and economic organisations could be easily observed (Levitas, 1991). In the European medieval city, the presence of walls expressed the cooperative unit, based on interwoven kin, work, and religious networks (Levitas, 1991:230). Trade and social life were practised together, and had the household as a starting point. Specialisation of street was beginning through specialisation of craft and the presence of the guildhall. However, integration of commercial, public and social life was expressed through the minimum separation between workplace and home and workplace and street.

The weather determined whether work was carried out indoors or outdoors; the barrier between interior and exterior was extremely penetrable, as were barriers between age groups. The streets were the place of children's and adults' games and activities, and were also places to access information (as formal schools did not exist for children), of excitement and adventure (thanks to close personal contact, crowding, and highly personal interchange). The street had economic, social and circulation functions mixed together, and even today in streets with such profiles, people have a less strained behaviour (ibid.:231)

Socio-economic and technological changes increased specialisation of streets. Planned streets became settings for the symbols of national power and class distinction (places of parades and carriages). The rise of nationalism, capitalism, technology and state power separated the old interwoven networks into distinct spheres of public life. The streets were differentiated by their use by new social classes. The upper classes used the new avenues as a stage to display their wealth and power. The lower classes used the narrow and back streets to escape the control of urban policies and to extend their cramped living space. The middle classes feared streets, and used them only as means to move from home to work and vice versa, frightened by the streets potential violence (ibid.:231).

The advent of city police accompanied the strengthening of the state and of international trade and alliances, favouring the rise of a cosmopolitan character in the boulevards of the biggest cities of the nineteenth century. With the increase in complexity of society, differentiation of street systems became increasingly complex. Many of the activities formerly practised on streets were removed indoors (entertainment, trade, information, services). The street became a place to be ordered and controlled, according to central rather than local norms (ibid.: 232).

Suburbanization reduced streets to their circulation function, while in central areas boundaries were created between buildings and streets to separate public and private domains. In developed country cities, slums and ethnical enclaves are the places that have best preserved streets as a place for public life, exhibiting processes similar to the medieval village, where moral order and social values are enforced through gossip passed along in street networks (ibid.).

Since Vitruvius's time, architects and designers have tended to have a platonic faith that symmetry and harmonic proportions would ensure perfection in space. This has created a tradition observed in present design and planning, favouring aesthetic ideals and a belief that forms have an impact on

people's social behaviour and happiness (Levitas, 1991: 225). However, Rapoport's (1969) findings showed that such rules do not create the effects which designers credit to them. In the rare cases in which design appeared to have a strong effect on behaviour and user satisfaction, there were social and psychological determinants in addition to physical ones.

Anthropologists suggest that ecological approaches (able to integrate livelihood systems, architecture, social behaviour, etc.) would be more effective in investigating the impact of each single aspect on inhabitants' lives, without considering any of them determinant upon the others (Douglas, 1970, cited in Levitas, 1991). The anthropological approach stresses participant observation, and immersion of the researcher in the culture he is studying in order to acquire a better understanding of inhabitants' attitudes and the interdependence of material and non material aspects of culture (Levitas, 1991: 227).

To clarify the contribution of space to human interaction, Granovetter (1982; quoted in Hillier, 1996) highlights space's ability to generate weak ties, or ties created by occasional interaction. Weak ties act as bridges between more homogeneous groups formed by ties of blood and duty (strong ties) and are considered by him the key to urbanity. The weak and strong ties are the social equivalent of the local and global scales of space, which must be balanced to create a well-integrated environment. Hence, space offers the middle ground between the local community and the transpatial network that is more or less independent of space (Hillier, 1996:257).

Other studies of the effects of social and physical distance on human interaction (Knox & Pinch, 2000:222) have shown that instrumental interactions (caused by professional and political interests) tend to be less dependent on distance (more transpatial), than instrumental interaction to achieve a common goal (e.g. to organise a party or to avoid the closure of a school), which presents more interrelation between physical and social distance. Voluntary associations (as the poor's networks of mutual support may be considered), based on class values and lifestyle (established to sustain social relationships) are also strongly correlated with space when there is correspondence of social and residential segregation.

In the 1990 Poverty World Development Report (World Bank, 1990; quoted in Moser, 1998) the reciprocity between households of a poor community, based on social ties, is seen as an asset to overcome poverty, as important as are health, education or house ownership. Box 4.5 presents findings of previous research about the role of streets in social networks in American slums; it illustrates street life of a kind much closer to informal areas in Brazil than non-urban communities in Asia and Africa would be. This data indicates that the time of consolidation and level of segregation

of a community play an important role in determining the quality of the social network formed in them, basically in their streets.

In this research, it is assumed that there is correspondence between communities and space in informal settlements; the investigation of ligatures is done through observation of streets, to learn about the poor's social contact with others in their neighbourhood by observing the use they make of space, or their environmental behaviour (Zeisel, 1981). From the spatial perspective, and in formal contexts, quality of social relationships are associated with the existing gradients between public and private spaces (Ford, 2000). The ideal sequence would be public, semipublic, semiprivate and private spaces. The first is represented by the busy street that should lead to the community's internal streets and to the space between buildings, and then to a building's interior. This hierarchy of streets should offer to inhabitants the possibility of enjoying territory and avoiding social and psychological problems in groups highly dependent on space, such as young children, who need to form locally-based friendships, and those who cannot afford the benefits of improved mobility and communication (Knox & Pinch, 2000;223).

Sidewalks, porches or verandas, walkways, steps, fences, among other spatial elements, are the physical amenities available to distinguish the different gradients between public and private spaces. In this way, demarcations of space or their absence may help the creation of bridges between communities, to ease social exclusion, and to favour co-operation rather than violence and competition within cities (Castels, 2000). In opposition to the Californian example, Castells cites the case of Barcelona's spatial interventions to promote peripheral centrality, an attempt to recreate the meaningful structure of the city, in order to prevent neo-tribalism physically, and provide for children a safe, open, fun and dynamic city, to allow them to grow up happily (ibid.:122).

Box 4.5. The role of streets in slums

Studies focusing on American slums as a whole and on juvenile gangs in particular indicate that streets are extremely important in slums. They provide primary references for their inhabitants and a sense of belonging and cohesion; they are also places to relieve the constraints of domestic life (Suttles, 1968; Yablonsky, 1962). Streets are the places of interaction of different ages, genders, and groups; they are also places of gossip and interpretative observation. They are the means to communication, since they provide opportunity for interaction at the same time as they protect inhabitant's scant privacy (Suttles, 1968:77).

Privacy in slums is scarce even inside homes, due to crowding, large families, and poor construction that always favours intrusion. In these environments, social life becomes so informal that any domestic exchange might enforce unpredictable exposures or confrontations that are not easily moved back from (ibid.:77-78). The street offers an escape to slum dwellers; it provides excitement and unscheduled experiences, and training in a relatively rigid system of relationships that provides a few techniques to encourage participation in the larger

society; informal network gossip is an effective means of information about the outside world (Liebow, 1968; Ulf Hannerz, 1969; Herbert Gans, 1962; Whyte, 1955; Lee Rainater, 1966; cited in Levitas, 1991:235).

Suttles (1968) found that there seems to be no standard of morality in street slums; therefore there are no general norms to be taken as a reference to evaluate individuals. In these areas, groups are differentiated by background and patterns of behaviour, and information is used most of all to maintain personal relationships, not a sense of community. Only when there is an external threat information is used to benefit the community. Groups share and keep their knowledge, and street gossip is an effective but quantitatively limited means to gain knowledge of inhabitants' personal characters. This system of information limits inhabitants' access to additional information from outside; this might result in the creation of stereotypes by inhabitants about the larger society, and difficulties in dealing with it (the wider society) realistically. (Suttles, 1968, cited in Levitas, 1991:234).

However, streets are still the best environment in which inhabitants can adjust and adapt themselves to a larger unit, and to experiment with different life-styles. Men look for a place they can call their own, since the domestic space is often considered a female world. In slums with higher levels of integration between groups and a longer time of consolidation, streets are used in a less segregated way. Age, sex, and social roles are combined with ties of kinship, work, religion to the point that Herbert Gans (1962) decided to call them 'The Urban Villagers'.

The role of streets varies according to the level of settlement segregation, but has the potential to offer to slum inhabitants opportunity of socialisation in expressive rather than instrumental terms, and provides them with education and security, although that security imposes the price of limiting flexibility and the extent of social networks (Levitas, 1991: 235).

4.3. Summary and conclusions

This chapter seeks for a method to accurately describe and analyse informal settlements patterns of formation and development over time, and the impact of those on inhabitants' life chances. From what was set out in Chapter 3 and in Chapter 4 it is possible to say that the housing problem in developing countries is not properly one of insufficient housing (the poor always succeed in producing housing over time), but of precarious integration of informal settlements into the existing city. Informal settlements have been considered chaotic and judged by elites as places to be ashamed of, and because of that have received upgrade based on formal standards, unsuitable to their spatial structure (observed through their configuration).

Despite the great deal of information available about land tenure, environment, urban growth and poverty, few attempts have been made to understand the underling structures within the urban form of informal settlements, perhaps due to the need to consider local physical, climatic, cultural and

socio-economic specificity. Tools from the urban morphology field were selected to investigate precisely the spatial underlying structures as well as the visible configuration of informal settlements through the relationships of different scales of interface (building/plot, street/block, district/city), in order to incorporate the local context's characteristics.

The street is taken as the main element of analysis, because of its capacity to mediate between the private and collective spatial scale and to receive an aggregation of investments in ownership and infrastructure that make them more resistant to changes than plots and buildings. To account for entitlements, streets are observed through the potential to displacement they offer within the urban space, assessed by space syntax techniques to measure centrality (using depth and global and local integration as indicators). These can provide evidence about the relativity of informal settlements' spatial segregation, usually imposed by a site's physical conditions, but possibly transformable over time, according to the informal grids' capacity of being embedded in the formal city grid through extension and upgrade of streets.

Provision recognises that scarcity of infrastructure is the main regulator of the land market in developing countries. It adds a different dimension to the potential of accessibility presented by space, introducing concrete differentials created by supply conditions and action of different agents (such as site physical conditions, location, zoning laws, difference between cost of land and prices achieved in the market, availability of infrastructure, accessibility conditions and street status within the city) that provide an explanation of the process of gentrification that happens in upgraded informal settlements. Provision searches for variables able to explain the process of street generation and consolidation, highlighting the threats of the usual non-synchronicity between space generation, increase of density of occupation and infrastructure provision to the perpetuation of a vicious cycle of poverty.

Ligatures consider streets' capacities of creating systems of barriers and accessibility, which help to regulate social interaction among social groups, and of working as centres of information. Differentiation between patterns of interaction (transpatial and instrumental) is provided to demonstrate how middle and upper classes have specialised streets over time, compromising the capacity of space to generate contact between people from different social groups and backgrounds. In general terms, homogenisation of public spaces prevents social diversity and favours centralised control. In environments dominated by poverty, streets have a very important role; they are the place where social networks are usually formed, knowledge about urban life is acquired, and to which the usually cramped domestic space is extended. Gradients between public and private space and physical amenities are physical means to create bridges between communities and to favour co-operation rather than violence within cities.

From the information on which this chapter was built, it is possible to say that poor people who live in developing country cities' informal settlements may be called 'urban citizens', since they are allowed to have a place within the city, and even more to produce it. However, the spatially expressed constraints on the exercise of this 'citizenship' are by themselves enough to make them 'second class citizens', who rely more on space than do other social groups, but are the disadvantaged users of an unevenly infrastructured space. The time span of consolidation of a settlement seems to be dependent on the potential of space to favour the process (i.e. by helping inhabitants to build their livelihood by giving access to social and physical infrastructure, by promoting the formation of weak ties). Some variables were chosen to describe how this happens and they are introduced in the next chapter, together with the research questions and the fieldwork methodology.

Chapter 5
The Research Design

Chapter 5 The research design

5.1. Introduction

This chapter presents the research design created to investigate how space affects life chances of land invasion inhabitants. The research design incorporates the theoretical discussion about the application of the concept of life chances in a context of poverty of a developing country city, and about the spatial dimension of life chances, to achieve the research aims.

A reminder of the research aims and research questions opens the chapter; these are followed by epistemological considerations that have guided data collection and analysis. Then a description of how data collection was carried out and how it was analysed is presented.

5.2. The approach of this thesis

5.2.1. The research aim and the research questions

The main question of this research is: What is the contribution of space to life chances of invaded areas' low income inhabitants?

This question was posed with the aim of encouraging upgrade actions oriented to the achievement of the consolidation stage, while ensuring the maximum retention of original inhabitants. To do so, this research has investigated potentials and constraints created by inhabitants' spatial solutions, how space affects inhabitants' achievement in a few basic aspects of their lives, and the participation of other agents in the process.

This approach was translated into three research questions to explore the relationship of space and life chances for the inhabitants and other agents directly or indirectly involved with informal production of space. It assumes that internal (inhabitants' motivations, level of organisation and resources) and external (official policies, regulations, funding conditions) aspects of the issue may have equal importance to the quality for the environment informally created and to inhabitants' long term prospects. The questions are:

1) To what extent do life chances in invaded areas depend on: a) location, b) timescale, c) configuration?
2) To what extent do inhabitants' perception and achievements of life chances vary according to the place where they live?

3) Are life chances improved, and if so to what extent, by the action of government and other agents on the physical configuration of invasion areas?

5.2.2. Justification

The studies of occupation of informal areas by low-income people have often focused either on socio-economic elements of the processes which originate the occupation, or on the amount of participation of invaders in decision-making related to upgrade actions, or on environmental issues in these spaces (Hardoy, 1989 and 1992; Magalhães, 1992). The approach of spatial analysis and evaluation in areas produced through invasions has been left out of solutions to the broad social, economic and political problems unsolved in these areas. Some approaches examine the up-grade spatial organisations proposed by governments, discussing and evaluating their economic viability without analysing or evaluating these spaces' logic prior to the interventions (Payne, 1984).

This research has been devised to examine this gap, through the study of possible contributions of the space informally produced to long term prospects of its inhabitants, or to any enhancement of their social, economic and political life. The socio-spatial focus adopted in this research takes the invasion process as a period of change that finishes with integration of invasion areas into the formal city. This process has been very common in the formation of Belém's periphery during the second half of the 20th century, and also in other cities also exposed to high levels of migration (IPEA/DAU, 1997; Payne 1984 and 1997; Browder & Godfrey, 1997).

To answer the questions above, the research design attempts to produce an approach able to access physical and socio-economic variables. The physical variables take into account opportunities of physical access to school, sources of income, housing and social capital, and the socio-economic ones consider the perception and effective accomplishment of such opportunities, through years of schooling, level of income, housing improvements, and participation in formal and informal organisations.

5.2.3. Agendas for the approach adopted

In a country such as Brazil, urban space production is expected to be institutionally regulated to some extent by all levels of government; however, access to formally-produced space depends on socio-economic factors such as income. Low-income people in developing countries can hardly afford formal standards of housing and often break regulations by producing informal space. This creates a particular problem from the researcher's perspective; it must be understood in order to justify the appropriateness of the methodological framework (Sayer, 1992:4, quoted in Ghafur, 1997: 104).

The context of inequality in this research led to an investigation of informal space, based on a bottom-up approach, through case studies, which privileges the inhabitants' condition as informal space producers and users. The land invasion process is one more confirmation of Foulcault's observations that policies and planning measures established to improve citizens' living conditions might have, sometimes, an opposite outcome (1984f, quoted in Flyvbjerg, 1998:201). Foulcault also reminds us that democracies should, above all, guarantee the existence of a public realm, instead of privileging consensus and uncritical maintenance of power though laws; his discourse advocates the importance of particular (as opposed to universal) contexts in demonstrating that the citizenship condition is fully achieved only when one has the freedom to fight for one's rights (Flyvbjerg, 1998:201-206).

Hence, users' needs were considered before institutional demands, to take cognisance of the informal nature of the object investigated. This does not mean that this research does not recognise the importance of institutions in regulating social relationships and social products, such as space. But it is focused on the evidence of the formal sector's incapacity to provide housing solutions to the poorest segments of society, and aims to offer support to overcoming that incapacity.

Conversely, this research recognises land invasions as low income people's strategy to confront the struggle with elites in power. By adopting the inhabitants' perspective, this research also expects to avoid a simple cost-benefit evaluation, and to reinforce the role of human values in understanding inhabitants' trade-offs (why do people choose a certain means to achieve a certain goal?). The recognition that values form part of any human action is part of a post-modern agenda which understands inhabited space as something never finished, to the same extent as inhabitants, who are producing the space, also change after every spatial modification, always demanding more spatial changes (Fekete, 1988: xi). This constant flow of change seems to be very pertinent to informal areas' processes of consolidation, where the inhabitant majority has historically felt powerless, without perceiving the demonstration of power and strength they have offered through their everyday struggle against poverty and housing constraints.

5.3. Design and implementation of the empirical investigation

The empirical investigation of this thesis had two stages: a preliminary fieldwork and the main fieldwork.

Preliminary fieldwork

This was carried out to identify key variables of floodplain occupation processes in Belém, and to support the case study area's selection. It has consisted of interviews with technicians of local and state companies involved in housing production, informal settlement regularisation and municipal cadastre production; plus interviews with inhabitants, preparation of photographic material and gathering of reports, maps and aerial views of possible case study areas. The preliminary field survey was carried out in January 2000, and supported a pilot study, developed to check theoretical assumptions and methodology.

Main fieldwork survey

The empirical information related to the set of research questions was collected at this stage. The following sections explain in detail methods and procedures adopted to collect empirical information in the main field survey.

5.3.1. Sample design

The spatial analyses of this research regard the settlements as a unit, and the households as sub units. Households are used as entries for spatial and socio-economic data, in order to allow cross-tabulations between both. As the research questions are strongly related to spatial attributes of the informal settlements, spatial analyses were taken as frames for social ones; the following sections describe the process of settlement and household selection.

5.3.1.1. Selection of case studies

The intention to observe the process of change in invasions has implied a comparison of a group of invasions at different stages of consolidation. The first step was to select possible case study areas that could provide different circumstances of consolidation (time of origin and location were associated). Three areas were selected due to availability of information, but in only two of them could a similar process of waterlogged areas occupation make comparisons easier. Tucunduba basin (in the city centre) and Paracuri basin (in the expansion area) were then identified as suitable locations of informal settlements within the city (Fig 5.1, see also Figs 7.2-7.5, on pages 189 - 192).

The available material was provided by aerial views, technical and academic reports and easy access to technicians involved in official actions carried out in the basins. The areas where big projects of upgrade and replacement had occurred or were in course were avoided, in order to keep levels of complexity manageable. Since basins were selected, it was possible to define the inner areas to be studied by using the information gathered from interviews and reports, and visiting the areas. The variables considered for final selection were original land ownership conditions, degree

of consolidation and inhabitants' socio-economic conditions. The first and second were checked through interviews, official maps and in-loco observations, and the latter was through mapped census data.

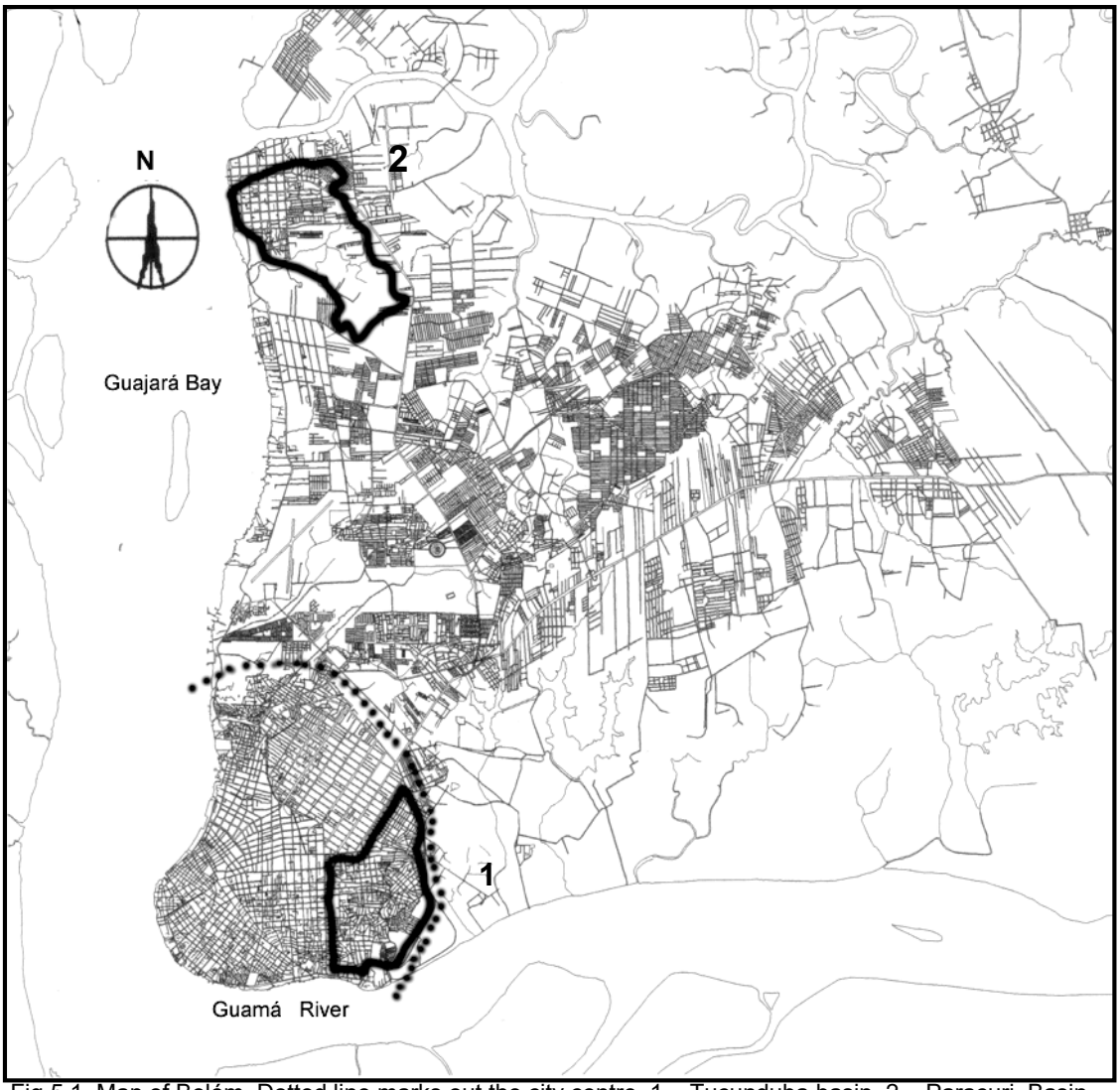


Fig 5.1. Map of Belém. Dotted line marks out the city centre. 1 – Tucunduba basin, 2 – Paracuri Basin
Source: CELPA/ CODEM, 1998.

According to the original land ownership conditions, areas were considered as previously either private or institutional property. According to their degree of consolidation, areas were divided into completely regularised, in the process of regularisation, and not regularised. Socio-economic conditions were observed through noting average income and average density per censitary (related to census survey) sector (an area corresponding to a set of 200 households).

This information was obtained from a technical report presenting the local government's proposal to built a canal along Tucunduba River and upgrade the river's banks (Prefeitura Municipal de Belém, 1999) (Fig 5.2 and 5.3).

5.3.1.2. Selection of informal settlements

From the pilot study observations, Santa Casa was selected as the oldest case; a former property of a religious organisation, it was donated to the municipality to allow regularisation (PMB, 1999). Since then, it has been completely drained and regularised; it is no longer an invasion site, but it was begun as such. Average level of monthly income of household heads is similar to the remaining invaded areas in Tucunduba basin (up to U$100.00) (ibid.; IBGE, 1991). In order to make comparisons between invaded and formally occupied areas, two areas adjacent to Santa Casa were selected, one facing an important local avenue and another being an official settlement (Fig. 5.4). These constitute the Control 1 area, and besides being spatially contiguous to Santa Casa, presented higher levels of household head's monthly income (from U$100.00 to U$200.00 along the avenue and from U$100.00 to U$400.00 in the official settlement) and lower levels of density than in Santa Casa, where most census sectors' density ranges from 300 up to 450 pp/ha, while in Control 1 density ranges from 150 up to 300 pp/ha (ibid.) (Fig 5.5).

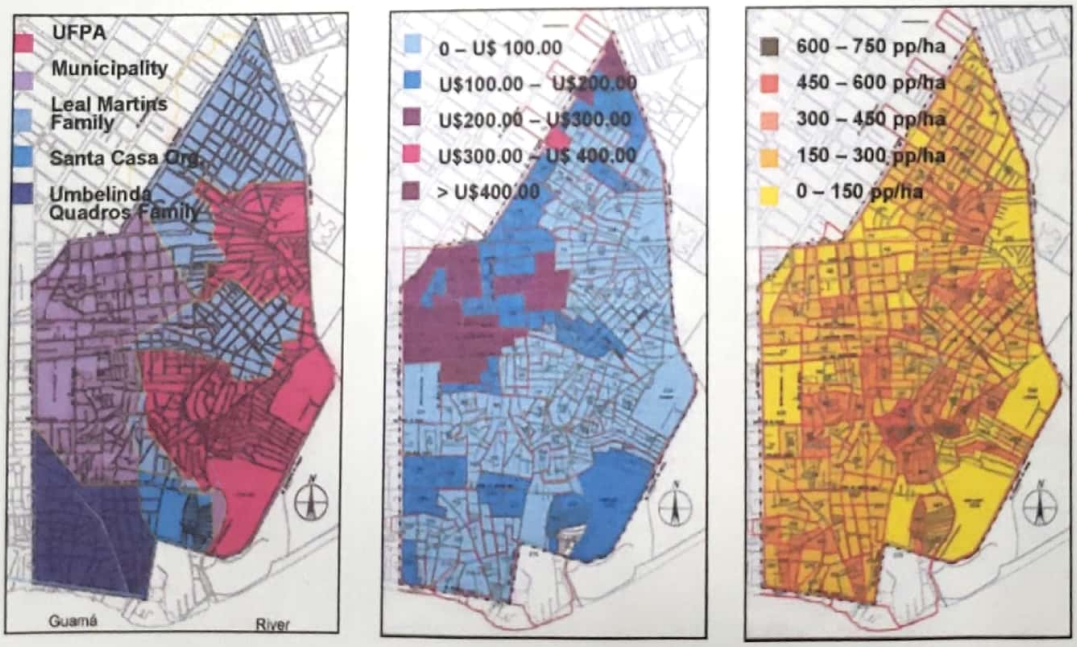


Fig 5.2. Tucunduba basin. Left –Present tenure ownership. Middle – Average income of household heads. Right – Density. Source: PMB, 1999/ IBGE, 1991/CELPA, 1998.

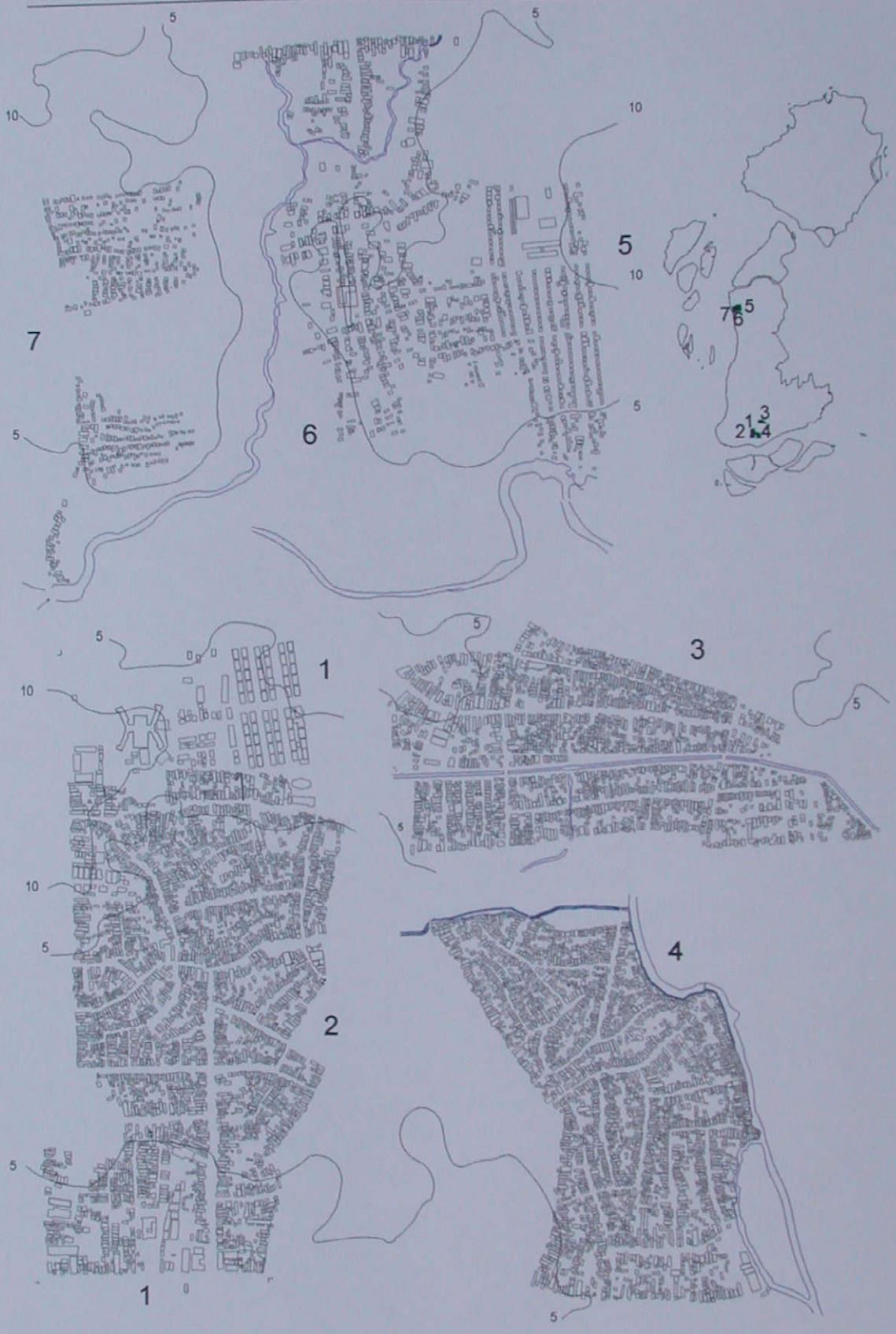


FIG. 5.3: MAP OF CASE STUDY AREAS

(Source: CELPA, 1998; CODEM, 1998)

Fig 5.4. Santa Casa case study area. Top – Caraparu street and canal, built during the 1980s. Bottom: left – good quality houses as a sign of gentrification, right – typical street and typologies.

Fig 5.5. Control 1 Area. Top: left – market located in the main avenue, right – open market along the street of access to the market. Bottom: Police office in the corner and first street of the official settlement (towards right).

Santa Cruz was the second selection. It is a federal property, where ownership regularisation is in negotiation, and physical upgrade is in progress. Drainage works have been carried out recently. Average income levels of household heads are similar to those in Santa Casa, as are densities (Fig 5.6). Tucunduba was the next area selected, located on federal property, where upgrade is in initial stages, average income levels are the same as in other invasion areas, but densities reach the highest levels of the whole basin (ranging from 300 to 750 pp./ha). Tucunduba has the worst spatial conditions of all areas in the basin, and is the negative control for case studies (Fig. 5.7).

Fig 5.6. Santa Cruz case study area. Top: left - bridge over Tucunduba river, right – Cipriano Santos Av., recently upgraded. Its canal crosses the Tucunduba river (the crossing between the two water streams is the reason for the name Santa Cruz). Bottom: left – middle of a block facing the avenue (note that plots are flooded); middle – alley of access to middle block; right –street that crosses the avenue.

Fig 5.7. Tucunduba case study area. Top: left, avenue that limits the area, recently paved; right, internal street, landfilled. Bottom: left, street in process of landfill with hard seeds from the açai, a local palm tree; right, occupation of waterlogged areas (Photos: Marcos Bittencourt, except top left).

The newest invasions are located in the Paracuri basin in the expansion area. The first is the oldest informal settlement in the basin, located between the formal grid and the river, in similar spacial conditions to the Tucunduba basin case studies (Fig. 5.8). The other case study in Paracuri basin was among the newest invasions in the expansion area, and is located between an existing road and a river (Fig. 5.9). Mapped socio-economic data about Paracuri basin was not available, but its physical characteristics and time of origin were considered sufficient data on which to base a choice. An official settlement, located adjacent to the Paracuri case study, and an avenue located on the boundary between the formal grid and the invasion areas, were taken as Control 2 (Fig. 5.10). They have similar spatial conditions to Control 1 in the city centre.

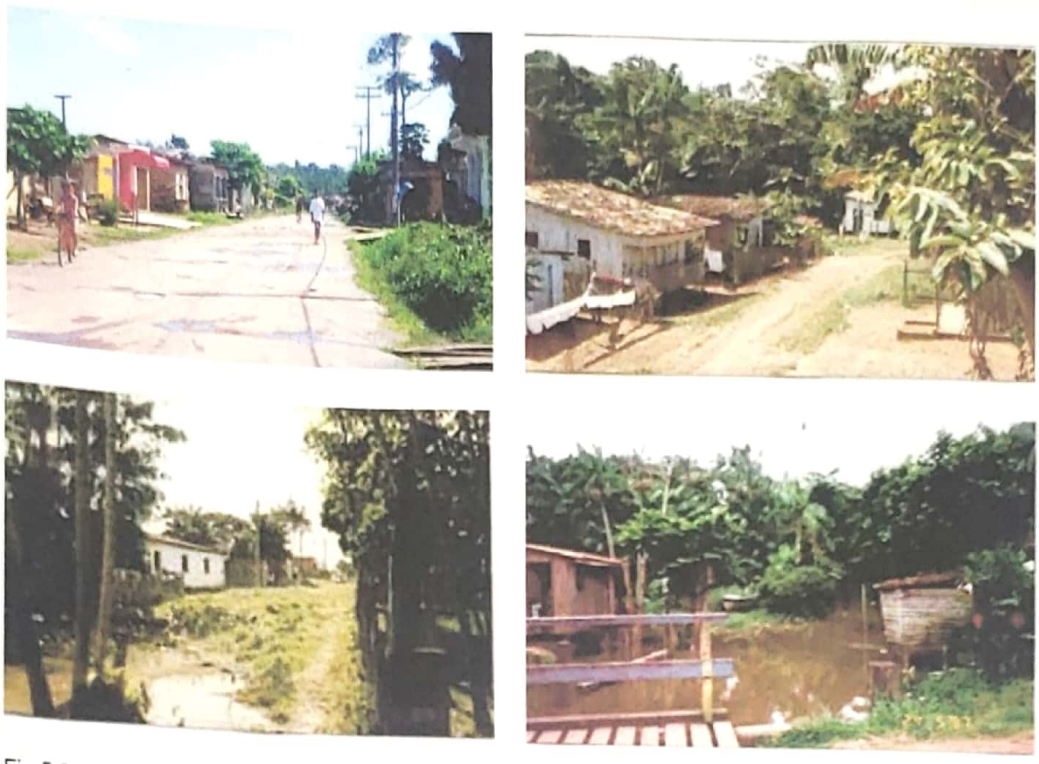


Fig 5.8. Paracuri case study area. Top: left, main access to the settlement; right, local street. Bottom: left, end of a street meeting a river; right, back of houses facing the river, note the 'bathroom' on the water. (Photos: Marcos Bittencourt, except top left).

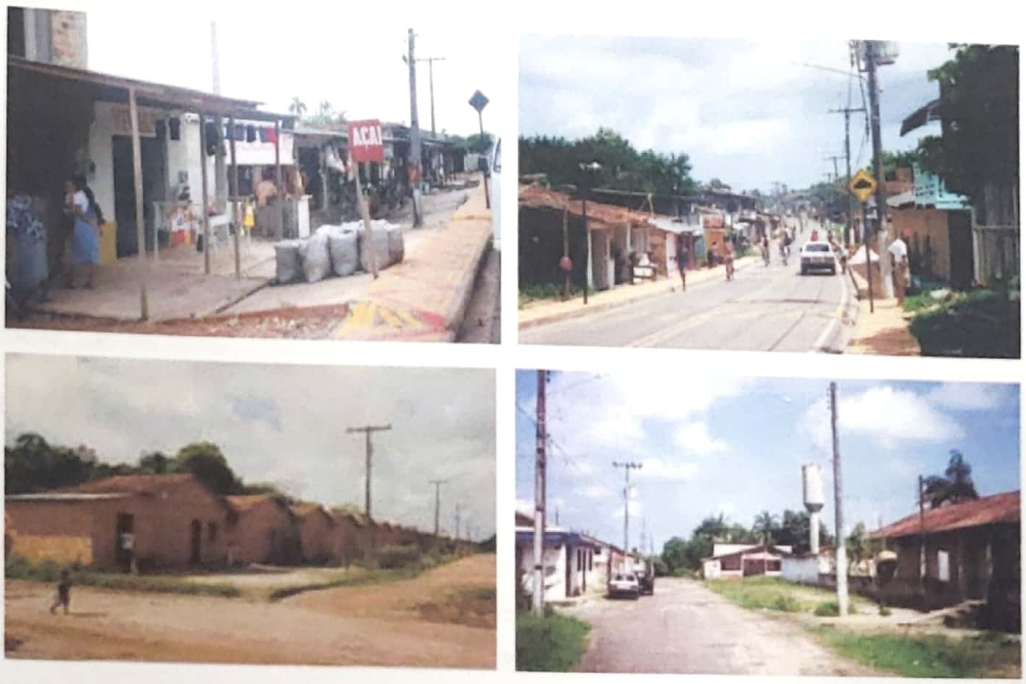


Fig. 5.9. Control 2 area. Top: left, shops in the avenue located between the formal city and one of the case study areas; left, view of the avenue. Bottom: left, official settlement (photo: Marcos Bittencourt); right, school in the official settlement.

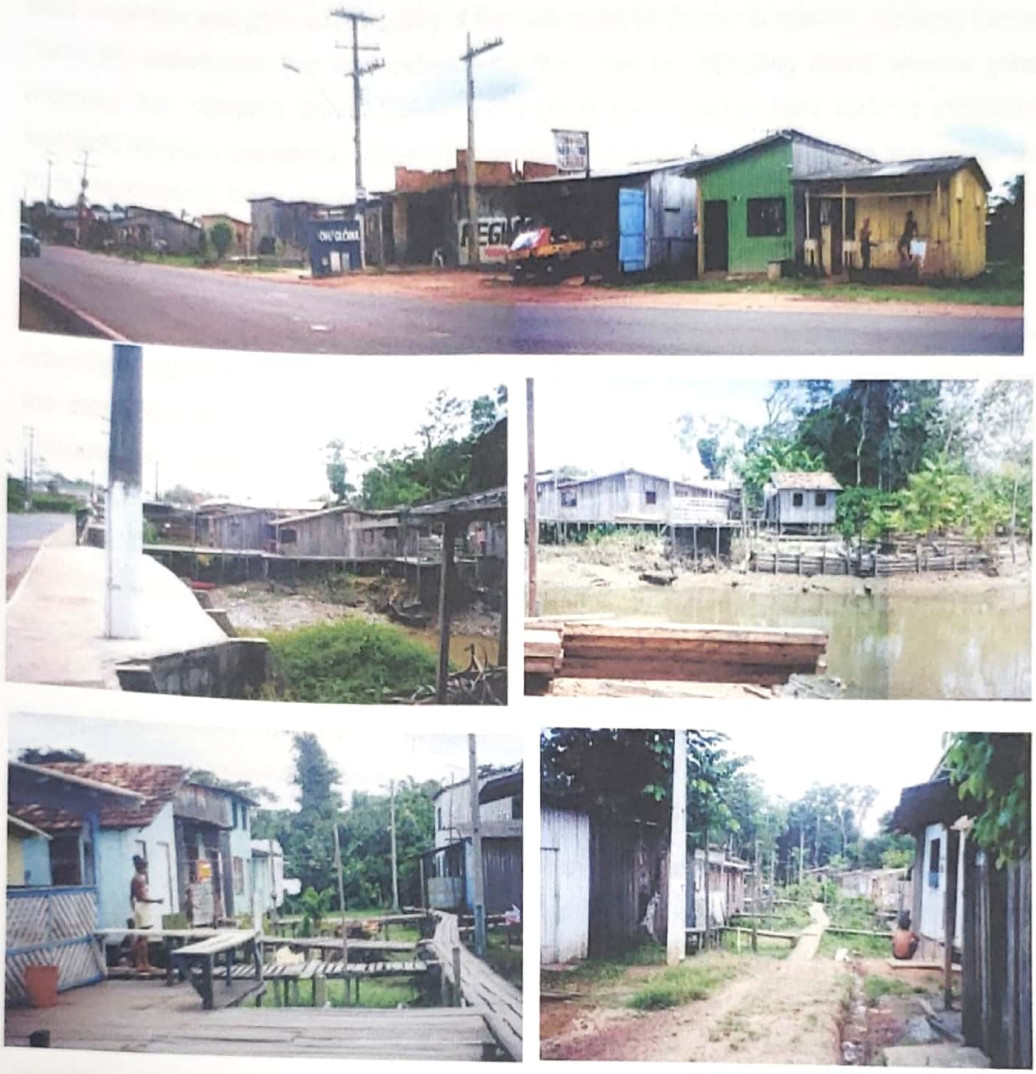


Fig 5.10. Arthur Bernardes case study area. Top: view of occupation along the road. Middle: two views of the occupation along the river bank (from the road). Bottom: left, end of a internal street (note front of houses connected through wooden raised walkways, locally called *estivas*); right, transition between landfill and *estivas*. Last two photos (bottom): Marcos Bittencourt.

5.3.1.3. Selection of households

Once case study settlements were delimited, preliminary analyses were made, using space syntax techniques in order to evaluate streets' accessibility potential (Hillier & Hanson, 1984, Hillier, 1996). This preliminary identification of accessibility potential was made through the observation of local integration levels expressed through lines of colour, representing streets, produced by the software Axman 3.0 (Dalton, 1990). Households were then randomly selected within settlements framed by street levels of local integration and segregation. The aim was to have at least one surveyed household located in each axial line crossing the case study areas to provide evidence about integrated and segregated households.

More emphasis was given to the quality of the data gathered than to its quantity, following Bulmer's (1998:98) assumption that in developing country cities non-sampling errors deserve greater attention than sampling errors. Non-sampling errors are related to facts such as precision of concepts adopted, operational definitions, good field staff instructions, knowledge and co-operation from respondents, living conditions, background, experience and workload of field staff, transport and communication, adequacy of supervision and so on (ibid.).

In the city centre, a sample of 2% of the number of dwellings in each case study area was adopted, resulting in 160 households being surveyed (40 in each case study area). The existing conditions in the expansion area were quite different from those of the city centre. There, settlements are discontinuous, smaller in size, and more homogeneous in terms of typologies of streets and buildings. For this reason the sample in the expansion area was established as approximately 1/3 of the total number adopted in the city centre, resulting in twenty households per settlement, and 60 households to be surveyed in total (Zarkovich, 1983; Whyte & Alberti, 1983). Through this process at least one household per outer face of block was surveyed in the areas of interest, and short streets had at least one surveyed household, whereas longer streets always had more than one surveyed household along them. This concern was justified by the need to use households as the means to cross-tabulate socio-economic and spatial variables.

However, these preliminary decisions were subjected to modifications imposed by circumstances of the fieldwork, such as interviewer performance and safety conditions. A few questionnaires were not administered as expected, while in other cases the original number was slightly exceeded, resulting in a total sample of 227 completed questionnaires out of 231 programmed. All the questionnaires were responded to some extent, and the number of responses stated in the cross-tabulations presented varies according to the variable investigated (corresponding to one or a group of questionnaires questions). Interviewers had received prints of aerial view, with households to be surveyed by them indicated, and were authorised to change to a next door or opposite household if they judged this would facilitate their approach to inhabitants.

5.3.2. Data collection methods

A case study is a methodological approach that incorporates a number of data-gathering measurements (Hamel, Dufour, & Fortin, 1993, quoted in Berg, 2001). Case study data-gathering methods range from participant observation, in-depth interviews, oral histories and life stories to documents (Hagan, 1993; Yin, 1994, quoted in Berg, 2001), and are used in order to produce information related to the research focus. Multiple methods increase the interpretability of

information and permit triangulation, or the 'bringing together of different types of evidence in order to test sources against each other' (Baker, 1999:255).

Human reality is a complex superimposition of images and constructions that must be observed from different viewpoints in order to have its richness apprehended and properly theorised (Bennet & Thaiss, 1967:307, cited in Ghafur, 1998: 114). Besides that, the socio-economic context of this research's case study areas, with regard to the personal safety of the researcher and her assistants, also required diverse sources of data in order to compensate for possible problems that could be experienced at the time of data collection. It was not possible to know beforehand precisely what would be achieved during the stages of fieldwork, since all researchers were strangers to the observed communities. The data collection methods used in this research are interviews, field observations, documentary sources and space syntax and morphological analysis. These are discussed next.

5.3.2.1. Interviews

Structured interviews, conducted through questionnaires, were used to permit data quantification and comparability. Questionnaires were designed to cover aspects of the three research questions, using closed questions, which were coded as variables and had answers analysed by SPSSwin package. Two databases were prepared, one having the household as the key entry, and another related to household inhabitants' socio-economic data. The household database was fundamental in allowing cross-tabulation between socio-economic and spatial data; the individual database was required due to the importance of the internal household profile to household socio-economic conditions.

The questionnaire included a table in which to enter the household's socio-economic profile (status of the household with respect to age, sex, occupation, income, and educational level), plus 32 questions organised in sections related to previous life conditions, accessibility to work, education and social organisation, social integration, changes in the built form, and perception of urban spatial qualities (each question had a list of possible answers supplied). These were asked of inhabitants by interviewers during working time, and due to such conditions, people who were working at home, were retired or housewives, were more likely to be interviewed. This was not considered a problem, since, as presented in Chapter 4, groups such as elders, children and housewives are precisely those who make a more instrumental use of space (Levitas, 1991; Castells, 2000). First of all, the interviewers introduced themselves, gave a brief explanation of the research aims, and assurance to inhabitants that the data was confidential, then they requested the inhabitant's agreement, and if the interview was accepted, the most suitable time to carry out the interview was agreed.

The interviewer was asked to take brief notes about interviewees' comments, interview conditions, and domestic environment, e.g. whether friendly and calm, or tumultuous and interrupted. This information offered a grasp of interview circumstances and was used to clarify data taken from this and other sources.

In order to prompt inhabitants' comments and to facilitate understanding of questions, a set of photos, an aerial view and a map of the settlements were available. The alternative answers to sensitive questions were presented on cards, and draft paper was provided to inhabitants to permit the drawing of mental maps, showing their main references and routes, and the most frequented spaces. The maps drawn and comments made by inhabitants were used to define the routes over which field observation was carried out. Another outcome of interviews was the arrangement of meetings with the oldest and friendliest inhabitants, in order to listen to their personal histories.

Semi-structured interviews were addressed to two type of interviewees: inhabitants previously contacted who had agreed to tell details about their personal experience of living in the settlement, and the technicians who are staff in local companies and had been involved in regularisation and upgrade of informal areas. The interviews with inhabitants (either in groups or individually) were shaped by a few topics similar to the questionnaire topics and were an excellent opportunity to raise details about inhabitants' perceptions of improvements in the settlement and possible justifications of their present condition.

The interviews with technicians were also guided by a few exploratory questions about their experience with interventions in informal settlements in general, and specifically in the case study areas. The researcher always conducted the interviews with technicians, and the choice of these interviewees was based on their long experience, concern and/or active participation in upgrade actions. The researcher's social network in the city, through which it was possible to approach interviewers with relative facility, made this choice possible. A few long and detailed interviews were preferred to more numerous short ones, in order to assess paradigms, historical facts and criticisms related to interviewees' experiences (Ward, 1983, quoted in Bulmer, 1983:98).

5.3.2.2. Field observations

Field observation aimed to observe inhabitants' usage of public spaces. It was organised over routes which covered most cited streets and places pointed to in questionnaire responses. This strategy was an attempt to guarantee observers' safety, and to make observation feasible over short periods. Field observations took place during three weekdays and one weekend in each case study area, covering early morning, noon, early and late afternoon periods in Santa Casa, Santa Cruz, Tucunduba, Paracuri and Athur Bernardes case study areas. Control areas were not the object of field observation, due to scarcity of time and financial resources; however, interviewers'

notes and observations about interview circumstances were used to clarify patterns of spatial usage in Control areas when needed.

Safety of research assistants was a concern. Although observers were the same people who had interviewed inhabitants using questionnaires, they were instructed to walk along the routes in pairs, and only during day-time. They were often seen as outsiders, entering a semi-private territory, identified by its inhabitants' heterogeneity (workers, children, retailers, drunks, criminals, etc.). When street inhabitants presented themselves as hostile to observers, the latter avoided walking along that street, and described only what they could see from the point where they were. Thanks to these measures, interviewers were never threatened in the field; far from this, they were mistaken for personnel of service companies (water, telephone and power). During the field observation, other complementary activities were carried out, such as map-checking and photographic surveys (which required either a companion to protect the photographer, or the use of small and inexpensive cameras).

5.3.2.3. Documentary sources

The documentary sources used in this research were firstly official reports and laws applicable to case study areas, setting out policies at any government level, local conditions of occupation, or presenting projects of upgrade in any case study area; these were obtained from municipal offices and local authorities. Secondly, academic and journalistic material and exploratory research related to case study areas, was obtained from libraries and researchers. They were used to situate data, and for acquisition of a better understanding of the action of different agents involved in the process of upgrade.

5.3.2.4. Space syntax and morphological analysis

Space syntax and morphological analysis were used to assess spatial variables for this research. In order to produce space syntax measurements, the whole of the basins' extensions were measured, since there had to be a bigger area covered by axial lines than that of the studied settlements' extension, to avoid distortions (Space Syntax Manual, 2001:2). The basins' axial maps allowed the measurement of global and local integration, and production of their respective maps and of depth maps calculated in relation to the most locally integrated line (the basin's most accessible street).

The production of Tucunduba's basin axial maps was based on an 1998's official map and 1986 and 1977 official aerial views, as registers of the last three decades. These maps allowed comparisons between measurements (global and local integration numbers and their correlations) and configuration characteristics (such as system sizes and type of evolution) of these different moments in this basin. The data produced was used to observe the contribution of time and

configuration to the evolution of spatial entitlements, or the potential for physical and socio-economic accessibility offered by space in the different locations.

Axial maps of Paracuri's basin were based on the 1998 official maps and on the 1986 official aerial view. At the time of the 1977 flights to produce the 1977 aerial view, there was no occupation where the present case study areas are located in Paracuri basin. The analyses used for the Tucunduba basin were reproduced in Paracuri, with the same objectives.

Morphological analysis was used to observe the physical counterpart to the potential offered by entitlements, called provision, and understood as a means to create physical and socio-economic accessibility. Settlement streets were classified according to their order of generation, to observe how sequences of street type are formed over time. These data were complemented with street width and infrastructure observations, and settlement density calculations.

5.3.3. Implementation of the main field survey

5.3.3.1. Training of interviewers and pilot test

A draft questionnaire was written in English, tested and discussed in Oxford. Necessary corrections were then made to content, order, and format of the questionnaire. Meanwhile interviewers were contacted in Belém from among the researcher's former students. By the time of the researcher's arrival in Belém, a group of eight interviewers (recently graduated architects and civil engineers) was formed; they were introduced to the research design, and to the version in Portuguese of the questionnaire, and trained to administer it.

As the questionnaire was used as a structured interview, training consisted in explaining how to be a good interviewer, according to Baker's (1999) five rules. She says that interviewers must: 1) understand the interview material, 2) commit themselves to complete the interview, 3) practice enough to feel confident and comfortable with the interview, 4) try to reduce the effects that personal qualities may have on the interview situation, 5) use common sense in dealing with potentially difficult situations: (ibid, 222-224).

Rubin & Rubin's (1995) stages of an interview were also explained to them: 1) creating a natural environment, 2) encouraging conversational competence, 3) showing understanding, 4) getting facts and basic descriptions, 5) asking difficult questions, 6) toning down the emotional level, 7) closing while maintaining contact (ibid, 128-139).

Interviewers practised among themselves, giving their comments about the questionnaire and finishing their preparation by taking part in the pilot test. An area with conditions similar to case

studies, but located in another basin, was chosen due to this similarity and to availability of material, to practice the same interview set as would be applied for real (maps, aerial view, and photos, besides questionnaires). The researcher and interviewers each went to a different block to test their approach, answer coding, time, and communication skills. The result was discussed and the final version of the questionnaire was produced (a sample questionnaire is given in Appendix B).

5.3.3.2. Administration of questionnaires

During the pre-survey stage, the researcher visited the case study areas, preparing photographic material and observing interview sites. As inhabitants are used to being approached by service companies' personnel, researchers (the national census survey was happening at that time), religious organisations' personnel, etc., it was decided to approach them directly, avoiding 'gatekeepers' and political leaders. This decision was justified on two counts: one of not taking the risk of having the research associated with these two groups, and the other of not having inhabitants intimidated by them (Peil, 1983:77). Contact with one household in each area was obtained through inhabitants' and researcher's common networks (e.g.: a municipality employee living in Santa Casa, a friend of a friend living in Santa Cruz, etc.) in case local support was needed. Meanwhile, the interviewers' training and the pilot test were carried out, and arrangements for the survey (transport passes and folders with survey material for interviewers) were concluded.

Each interviewer was expected to conduct two interviews per day, taking into account that he/she would need to set a time to come back later, in some cases. They were instructed to work in pairs until they had enough confidence or considered themselves safe enough to work on their own. Unexpected doubts were normally sorted out by phone with the researcher, and a report about the interview circumstances was given with the return of questionnaires. Previous knowledge about interviewers' capacity to carry out this type of task from knowledge of their academic record was fundamental to researcher confidence in their work, since the researcher herself could not be present in the field very often, due to her advanced pregnancy. No questionnaire interview was cancelled, although four were not entered into the database. One was returned too late, and other interviews were repeatedly postponed, and could never be carried out.

Interviewers were instructed not to conduct the survey during lunch-time or after five p.m., and to try to carry out the interview without stopping interviewees' routine work. After two weeks of the survey beginning, meetings with inhabitants who had agreed to provide further information were started. The researcher conducted informal interviews in meetings with small groups of neighbours in three of the case study areas. Where individual meetings were more feasible, the most experienced interviewer conducted the informal interviews, supported by a framework of topics and sub-questions. Meanwhile, the researcher contacted and conducted interviews with technicians.

5.3.3.3. Implementation of field observation

When the main survey was concluded, adjustments were made in the interviewer group, in order to select pairs to carry out the field observation and to check maps in loco. The observers received more training, following Zeisel's (1981) elements of environmental behaviour observation: 1) actor, 2) act, 3) significant others, 4) relationships, 5) socio-cultural context, 6) physical setting (ibid. 123-136). A chart was designed to receive notations, and was complemented by an aerial view and draft paper to pinpoint actions along the route. Routes were internal to case study areas, and chosen as a result of the most frequented or best known places according to questionnaire responses.

The observers already knew the settlements and were instructed to walk in pairs along the routes as passers-by, at the selected times and on weekdays. Other pairs of former interviewers went to the field to check narrow paths, physical street conditions and land use.

5.3.3.4 – Limitation and accuracy of the data

One of the main dilemmas of the fieldwork was the questionnaire's length, since interviews could become tiring to interviewees. However, the questionnaire was considered the best source for the information needed. Because of that, if the household intended to be surveyed was closed, easily approachable inhabitants next door (who were at the front door, watching the streets or working in stalls or shops), were preferable to contact. This does not mean a bias in favour of a type of inhabitant, since inhabitants are generally seen outdoors, performing the most varied tasks in these environments. There were a few cases of insinuated hostility from one of a household's inhabitants, but it was always possible to obtain information from other household members who were willing to reply. It was harder to agree a time to interview housewives, who had to perform their domestic tasks and to take care of children at the same time, and to convince wealthier households to participate. The reaction of inhabitants was one more clue about settlement characterisation. There were cases of interviewee disappointment; for instance, after the questionnaire was completed, an interviewee realised that it had been just an academic purpose. One had expected to benefit from the researcher's presumed political links.

Sensitive questions did not prove to be a problem in most cases, but household socio-economic profile was not always gathered, due to interviewee uncertainty about other household inhabitants' information, or to unwillingness to provide information. This attitude was more frequent among the very poor, and the wealthier. Despite difficulties, the individual databases received 1024 entries. To avoid limitations on accuracy, some topics were cross-checked in different answers, to allow triangulation of variables, especially those related to access to income.

5.4. Data analysis and interpretation

5.4.1. Preparation for quantitative data analysis

Questionnaire answers were coded in detail according to questionnaire sections before data entry. Data was entered by the SPSSwin package into two main databases: one having the household as key, divided into thematic sections, which received 231 entries; and another having individuals as key, to receive socio-economic data, and with 1164 entries. The household database also received spatial data generated through syntactic measurement and classification of physical attributes of space (street type, street condition, street width), and selected variables from the second database (highest number of schooling years per household, highest income per household, workers-non workers ratio). This procedure allowed the cross-tabulation between spatial and socio-economic data used in the empirical chapters' analysis. Any inconsistencies were checked back to original data and to the interviewers' notes. Analysis of questionnaire data was carried out through univariate, bivariate, and trivariate analyses, usually describing frequencies and the arithmetic mean of single variables, relationships between two variables and relationships between three variables respectively (Voelkl & Gerber, 1999).

The procedures required to enable the relationship between data gathered from questionnaires, space syntax and morphological analyses to be tested against each other, were carried out as follows. The range of global and local integration calculated from the 1998 map was first put into descendent order, then divided into deciles, so that the values found in each decile band could be replaced by a respective absolute number (global and local integration values found in the first decile were replaced by 1, in the second decile were replaced by 2, and so on) (Tables 5.1 and 5.2) (Holanda, 1997: 88-89). This generated a classification based on the space syntax measurement that could be entered in the questionnaire databases, having the household number as its key. The measurement of the axial line corresponding to the street where the surveyed household was located was replaced by a decile number and entered into the respective column (i.e.: a column for local integration was formed of decile numbers for local integration).

Table 5.1. Conversion to deciles of syntactic measurements of the streets where surveyed households are located in the city centre (1998)

Entered number	Corresponding range of global integration	Corresponding range of local integration
1	2.2341 – 2.07458	5.6270 – 5.08539
2	2.07457 – 1.91506	5.08538 – 4.52378
3	1.91505 – 1.75554	4.54347 – 4.00217
4	1.75553 – 1.59602	4.00216 – 3.46058
5	1.59601 – 1.4365	3.46057 – 2.91895
6	1.4364 – 1.27698	2.91894 – 2.37734
7	1.27697 – 1.11746	2.37733 – 1.83573
8	1.11745 – 0.95794	1.83572 – 1.29412
9	0.95793 – 0.79842	1.29411 – 0.75251
10	0.79841 – 0.6389	0.75250 – 0.2109

Table 5.2. Conversion to deciles of syntactic measurements of the street where surveyed households are located in the expansion area (1998)		
Entered number	Corresponding range of global integration	Corresponding range of local integration
1	2.0568 – 1.9129	5.6759 – 5.1294
2	1.9128 – 1.7690	5.1293 – 4.5829
3	1.7689 – 1.6251	4.5828 – 4.0364
4	1.6250 – 1.4812	4.0363 – 3.4899
5	1.4811 – 1.3373	3.4898 – 2.9434
6	1.3372 – 1.1934	2.9433 – 2.3969
7	1.1933 – 1.0495	2.3968 – 1.8504
8	1.0494 – 0.9056	1.8503 – 1.3039
9	0.9055 – 0.7617	1.3038 – 0.7574
10	0.7616 – 0.6178	0.7573 – 0.2109

The depth measurements (obtained through the point depth map), which show the number of steps that each line of the system is from the two most locally integrated lines[1], was transferred as a column of depth to the databases. The depth of the axial line corresponding to the street where the surveyed household is located was entered straight away into the column of depth. Street type, street width and infrastructure condition were coded and entered into the databases, as these variables were observed where each household was located. This made cross-tabulation with space syntax measurements feasible, and allowed quantitative comparisons between case studies' urban forms.

Finally, selected variables from the databases were plotted with the help of AutoCad Map, to complement the statistical analyses by allowing visual observation of their spatial patterns. This was done to clarify the relationship between socio-economic data, syntactic measurements and street physical conditions data.

5.4.2. Preparation for qualitative data analysis

Inhabitants' interviews were coded through successive readings and topic identification, according to variables presented in the questions asked. One chart was designed to receive data from interviews held in the same area, making information easily identifiable and comparable. This information was used to interpret, justify or provide a background to questionnaire findings. Technicians' interviews were coded according to the specific needs of each interview, with codes generated by the data; a matrix was created to summarise each of them and to make information easily identifiable. The matrix's summary of an interview was compared against other interviews and against documentary sources in the search for information triangulation.

[1] After tests using each of the most integrated lines as references in Tucuduba basin, it was found that to take only one line would distort results for the case study furthermost from the line chosen, due to the configuration of the system. The line located northwards is the second most globally integrated in the city system and the line southwards corresponds to the main commercial avenue in the basin. For Paracuri basin, only the most locally integrated line was used.

5.4.3. The design of empirical chapters

The empirical data produced was analysed to answer the three research questions addressed in the empirical chapters.

In **Chapter 6** entitlements were initially assessed through comparisons of global and local integration and depth over three moments in time (1977, 1986, 1998), to indicate the area's potential for integration into the city in each moment, and to detect the changes occurring over time. The results to 1998 were then cross-tabulated with socio-economic variables to check how much the areas' accessibility potential affects inhabitants' physical access to education and income. The variables used in this checking were: a) highest individual income per household, b) highest number of schooling years per household, c) time of journey from house to school, d) means of transport from house to school, e) household size, f) ratio between workers and non-workers per household, g) period of settling in the present household. Their sequence of presentation was defined by requirements of clarification of the previous in relation to the following variables, until it was possible to reach a conclusion about the question investigated.

The assessment of the provision element aims to investigate underling rules of the process of settlements' evolution that turns them into an asset to overcome poverty. This starts with the classification of streets according to their process of generation and evolution. Then, street types were cross-tabulated with depth (one of the syntactic measurements) and other physical characteristics of streets (street condition and street width). These analyses were followed by consideration of density, climatic conditions and infrastructure provision. The assessment of ligatures provides evidence about possibilities delivered by space to inhabitants, who they are and how they behave; this was done through observation of characteristics of the urban form, of users and of the relationship between users and space.

Chapter 7 searches for inhabitants' attitudes towards Chapter 6's findings. It first provides a socio-economic profile of case study areas, through cross-tabulations between gender, household size, cohabitation of generations, place of origin, age, individual income, and individual schooling versus location (it showed the frequency of these variables per case study area). Later the achievements in access to education and income were assessed through cross-tabulations between age and schooling, age and occupation and location of attended schools, to account for entitlements.

The perception of achievements (accomplished through upgrade actions) regarding housing provision was assessed first through the frequency of choice of answer to questions about previous housing conditions (rent, owned, borrowed, etc.) and to type of housing access per case study area (purchase, rent, invasion, etc.). Further cross-tabulations between answers selected about period of

settlement in the present house, previous plot occupation, perception of street change, type of street change, promoters of change, plot and house adaptation, time of refurbishment, type of plot adaptation and type of enlargement, with location (case study area identification) provided more evidence to assess how much the house and the street have been used as an asset to enhance inhabitants' life chances.

The reasons for inhabitants' choices are provided through the assessment of ligatures. This is done through cross-tabulations for motivations for plot/ house selection (physical conditions, price, location, and possibility of enlargement), perceived conditions of accessibility, safety, beauty and cleanliness, relationship with neighbours, participation in formal and informal organisations, intention to move and location (case study area identification). These variables identify the motivations and trade-offs practised by inhabitants and some mechanisms of their social networks.

Chapter 8 offers further explanations of socio-spatial relationships, based on the direct or indirect interference of other agents in the case study areas' occupation. The delivery of entitlement was investigated through establishing the orientation of the national and local policies and laws established during the four last decades (which assisted the progressive intensification of informal settlement production in Belém). The delivery of provisions was investigated through the record of official production of low income housing, resulting from the policies previously presented. Ligatures were discussed through the paradigms used by funding agencies, state and local government with regard to upgrade actions and inhabitants' needs.

The progressive association of variables is justified by the exploratory nature of the research and need of clear articulation of socio-economic and spatial aspects of the same process. This made the presentation of evidence sometimes unattractive; in order to overcome this difficulty, the sub-conclusions to each section summarise the findings which are used at the end of each chapter to answer the respective research questions.

5.5. Summary

This chapter presents the research aim: investigation of the contribution of space to life chances of invaded areas' low income inhabitants, in order to encourage upgrade actions oriented to the achievement of the consolidation stage, while ensuring the maximum retention of original inhabitants. And it also presents the research questions.

The research's empirical design benefited from the theoretical framework's potential for a bottom-up approach, able to recognise settlement in informal settlements as a strategy of low income people

to confront the struggle with elites in power. Avoidance of a simple cost-benefit evaluation, and the reinforcement of recognition of the role of human values and agency in understanding inhabitants' trade-offs were considered as important targets of the method of enquiry.

The spatial variables present in the first research question (location, timescale and configuration) have oriented the selection of the two basins where the case study areas are located. The selection of case study areas within the basins was based on socio-economic variables and stage of consolidation (Table 5.3), while selection of households was spatially based. A triangulation between different methods of data collection was designed to crosscheck evidence; these methods were interviews, field observation, documentary research and space syntax and morphological analyses.

Table 5.3. Summary of Case study areas' characteristics

Location	City Centre – Tucunduba basin				Expansion area - Paracuri basin		
Time of origin	1960s		1970s		1980s		1990s
Case study	**Control 1**	**Santa Casa**	**Santa Cruz**	**Tucunduba**	**Control 2**	**Paracuri**	**Arthur Bernardes**
Original site	Dry land	Flood plain	Flood plain	Flood plain	Dry land	Flood plain	Flood plain
Previous owner	Private	Private	Public	Public	Private	Private	Private

All the quantitative data is analysed through cross-tabulations; the qualitative data is used to explain findings, and to provide evidences about agents' relationships with the process, according to the requirements of each research question. The following chapters (six, seven and eight) address the three research questions, presenting their respective data and analyses.

Chapter 6
The Alternative Space of Informal Settlements

Chapter 6 The alternative space of informal settlements

6.1. Introduction

The aim of this chapter is to explore the contribution of case study areas' space to their inhabitants' life chances through space syntax and morphological analyses, and through these analyses' cross-tabulation with socio-economic data. The empirical evidence produced answers to the first research question: **To what extent do life chances in invaded areas depend on: a) location, b) timescale, c) configuration?** The first section introduces case study areas' spatial characteristics and the socio-economic variables selected to be cross-tabulated with spatial data. The second section investigates the potential for physical and socio-economic accessibility offered by space, as entitlements. The third section investigates the physical counterpart to entitlements, the means to physical and socio-economic accessibility given by space, as provision. The fourth section explores how inhabitants deals with means and potentials previously assessed, by observing their patterns of public space usage.

6.2. The areas selected for research

6.2.1. Sites

The oldest occupied areas within the Tucunduba basin are located in its portions of dry land; these areas are representative of the transition process between the occupation of higher lands and the floodplains. Farms and market gardens originally occupied the waterlogged areas. Residential use was sparse; only those who worked on farms of gardens used to live in these areas. As densities have increased, the site's transformation has evolved through vegetation removal, building of wooden houses on stilts, and definition of walkways by trunks of trees, followed by a series of landfill works, first of public spaces and later of private plots (Figures 6.1, 6.2, 6.3, 6.4).

In the Paracuri basin the flood was less extensive than in Tucunduba basin. There was a higher proportion of higher land and by the time of official settlement building, drainage works were developed to divert the permanent floods, although they still occur during the rainy season (Fig. 6.1, 6.5).

6.2.2. Generators of space

Households located in an official settlement, in a private settlement and along an avenue define Control 1, which surrounds the Santa Casa area. During the 1960s the area was peripheral, although connected to the city through extension of its grid's streets, and had as its major land uses hospitals and cemeteries. The Santa Cruz area was formed on land compulsorily purchased by the

FIG. 6.1: MAP SHOWING LOCATIONS OF CASE STUDY AREAS
(Source: CELPA, 1998; Oliveira *et al.*, 2000; PMB, 1999)

Fig 6.2. Aerial view of Tucunduba basin
Source: CODEM (1977)
1 – Cemetery
2 – University campus
3 – Old tannery
4 – Official settlement

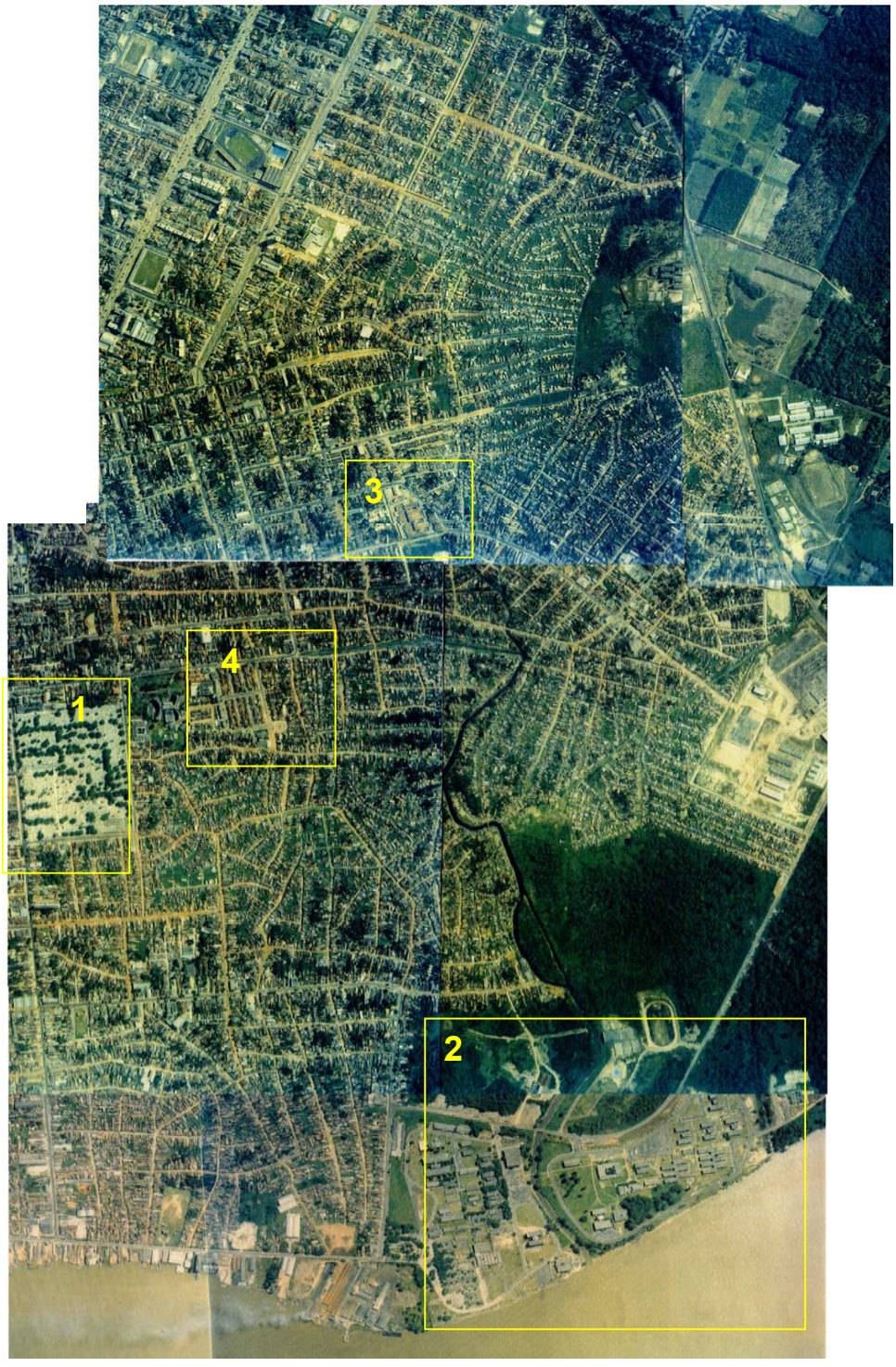


Fig 6.3. Aerial view of Tucunduba basin. Source: CODEM (1986)
1 – Cemetery
2 – University campus
3 – Old tannery
4 – Official settlement

Fig. 6.4. Aerial view of Tucunduba basin. Source: CODEM (1998)
1 – Cemetery
2 – University campus
3 – Old tannery
4 – Official settlement

Fig 6.5. Aerial view of Paracuri Basin. Source: CODEM (1998)
1 – Icoaraci village
2 – Industrial area
3 – Central Park (informal settlement located on Arthur Bernardes Road)
4 – Guará (informal settlement located on Arthur Bernardes Road)
5 – Paracuri (locally called Old Paracuri)
6 – Official settlement

central government to give a site to the Federal University of Pará. A tannery and its workers' settlement previously occupied the areas. Tucunduba is also located within the huge University property, but it is closer to the Tucunduba River; the riverbanks were an attraction to occupation because of the alternative means of transport and the natural landscape which they provided (Fig 6.2, 6.3, 6.4).

An official settlement and households located along the last street of the historic grid define the Control 2 area, which is in the city expansion area. Paracuri case study settlement was formed in the space between the historic grid and the rivers, on a site of clay exploitation. Arthur Bernardes' case study settlement is formed by three settlements located along a road which connects the historic city expansion area to the city centre. The settlements are located in front of fish and wood industries located on the Bay bank (Fig. 6.5).

6.2.3. Inhabitants' profile

This chapter is dedicated to the evaluation of spatial empirical data, although some sets of social data gathered through questionnaires, and related to inhabitants and household characteristics, are also introduced here, due to their relevance to the spatial assessment of life chances. In order to analyse the entitlement dimension of space, the following variables were selected to check the relationship between spatial attributes and social variables related to access, to income, and to education:

- Household size, which ranges from 1 to 19 inhabitants and presents 5 inhabitants as the most frequent number (mode). The distribution of household sizes over case study areas is tabulated in Table 6.1, showing that the biggest households occur within the city centre rather than in the expansion area (see also Fig 6.6 and Table 7.6, on page 185).

Table 6.1. Household size per case study area (percentage in each size band)[1]
(92.2% of interviewees answered this question)

	City Centre – Tucunduba basin				Expansion area – Paracuri basin		
Household size	Control 1	Santa Casa	Santa Cruz	Tucunduba	Control 2	Paracuri	Arthur Bernardes
0 – 1	-	2.9%	4.9%	-	6.3%	6.6%	8.4%
2	2.6%	14.7%	7.3%	-	6.3%	10.0%	8.3%
3 – 5	61.5%	44.1%	58.6%	56.8%	62.6%	63.3%	78.1%
6 – 9	30.8%	32.3%	14.5%	36.3%	18.8%	16.6%	4.2%
10 – 12	5.2%	2.9%	9.7%	4.5%	6.3%	3.3%	-
13 – 19	-	2.9%	4.8%	2.3%	-	-	-
Total	100%	100%	100%	100%	100%	100%	100%

[1] Totals in the tables presented in this and in the next chapters do not always sum to100 due to rounding off of decimal places by the SPSSwin software.

FIG. 6.6: MAP OF HOUSEHOLD SIZE

Source: CELPA, 1998, CODEM, 1998

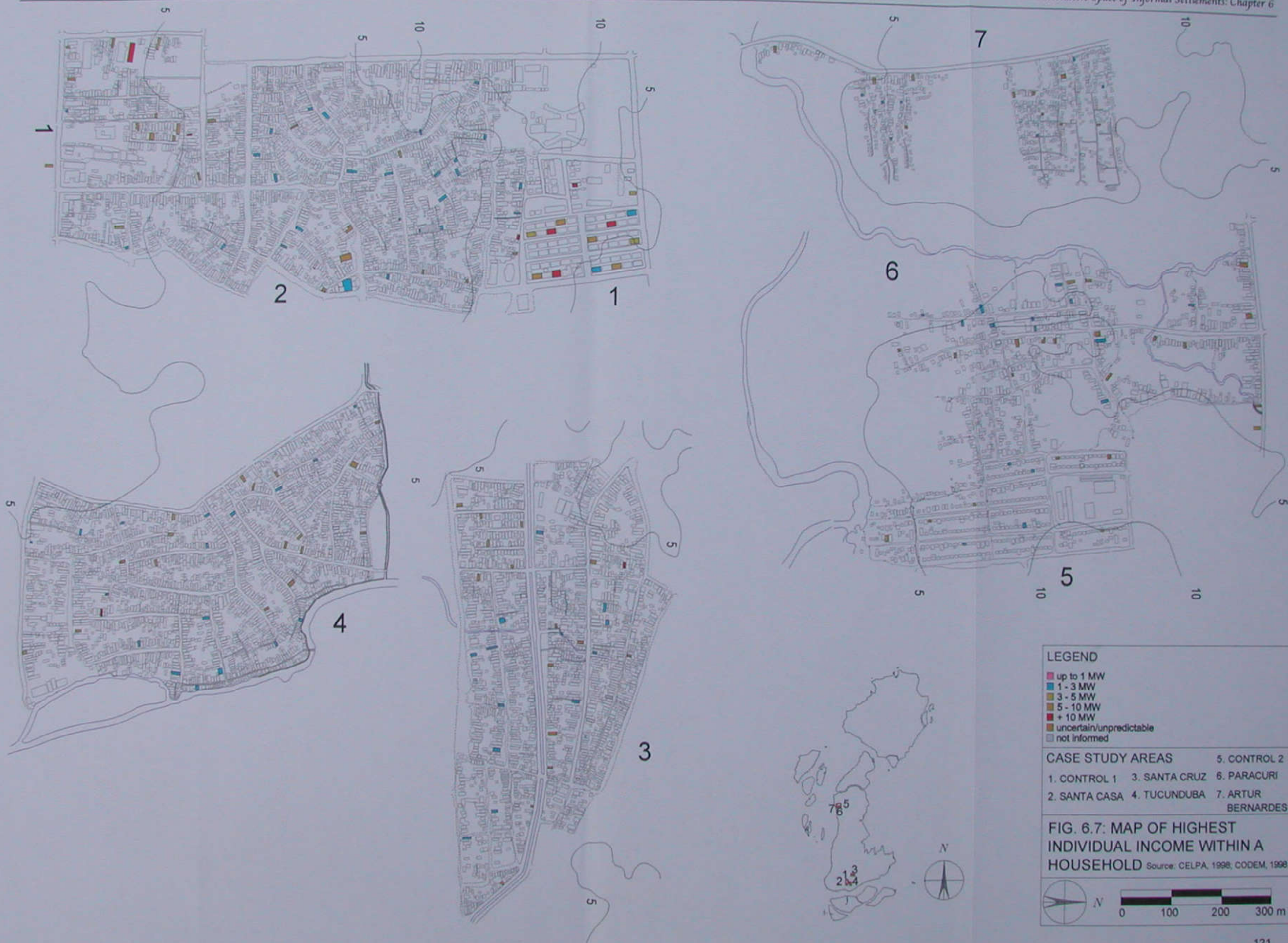


FIG. 6.7: MAP OF HIGHEST INDIVIDUAL INCOME WITHIN A HOUSEHOLD Source: CELPA, 1998; CODEM, 1998

FIG. 6.8: MAP OF WORKERS TO NON-WORKERS RATIO

Source: CELPA, 1998; CODEM, 1998

FIG. 6.9: MAP OF HIGHEST INDIVIDUAL SCHOOLING WITHIN A HOUSEHOLD Source: CELPA, 1998; CODEM, 1998

FIG. 6.10: MAP OF PERIOD OF SETTLEMENT IN THE PRESENT HOUSEHOLD Source: CELPA, 1998; CODEM, 1998

- Highest individual income per household, illustrating the most positive income achievement. The distribution of this variable over case study areas is shown in Figure 6.7[2].

- Ratio between numbers of workers and inhabitants per household, selected to give precision to the understanding of the previous variable. It ranged from 0 (when all inhabitants declared no access to income) to 1 (when all inhabitants within the household had access to income). Its distribution over case study areas is shown in Figure 6.8.

- Individual longest schooling years, illustrating the most positive education achievements. The distribution of this variable is shown in figure 6. 9.

- Period of inhabitant's settlement, shown in Figure 6.10. Times were periodicised according to past state governors' terms of office, to allow tracking of political influence on introduction of new households into case study areas.

6.3. Entitlements

6.3.1. Syntactic measurements

The space of case study areas was asynchronously created by gradual occupation. It was generated by the mix between extension of existing streets and creation of new small grids oriented towards an edge. From the whole city perspective, the informally occupied areas are differentiated by the absence of clear order, in opposition to the historic city grid's regularity. Comparisons were made between the syntactic measurements of both areas to assess the implications of location and configuration on the potential of streets to provide access to desired goals or destinations (and to work as entry tickets, or entitlements). The contribution of timescale is considered through the gap between the case study areas' time of origin, and refined through comparisons between maps that isolate lines correspondent to different moments of settlement evolution in both basins.

The case study areas have different levels of global integration when the city's street system is measured as a whole (Fig. 6.11); those located within the city centre have their axial lines among the 40% and 30 % less integrated lines, while those areas located in the expansion area are among the 20% and 10% less integrated ones (this means that they are among the most segregated lines of the system). This indicates that segregation increases with distance from the most integrated core

[2] The highest numbers of individual schooling and income were chosen, rather than averages, to allow cross-tabulation between socio-economic and spatial data in the main databases, which generated the maps and the tables presented in this chapter.

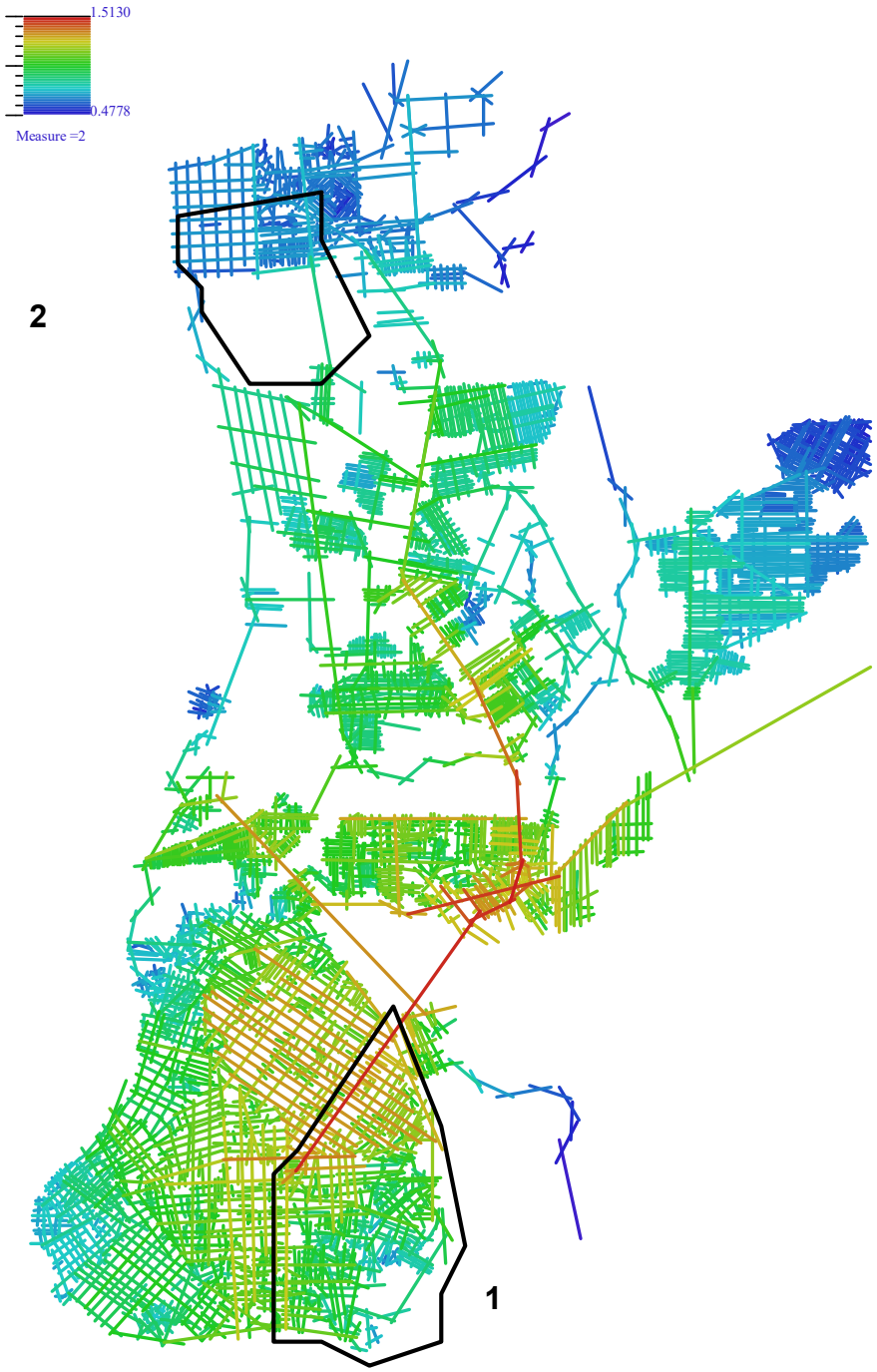


Fig 6.8. Belém's map of global integration. Adapted from Lima (2000: 128). Colour range presents descending order of global integration values, red indicates the most integrated lines, deep blue indicates the most segregated lines.

1 – Tucunduba basin
2 – Paracuri basin

in Belém (the city centre grid), and that case study areas located in the expansion area tend to have a weaker centrality compared to the city centre's case study areas. From the outset, this indicates a possible enhancement of opportunities for city centre case study areas' inhabitants to build a livelihood from street vending, domestic and casual jobs in middle and upper income environments, of having easier access to social and physical infrastructure and of being in contact with different social groups and patterns of urban behaviour. These are assessed throughout this chapter.

In Tucunduba basin, measurements of local (R3) and global (Rn) integration in the 1970s and the1980s indicate that inhabitants were more successful in understanding the structure of the urban grid (by moving on the streets) than an outsider (see Section 4.2.2). The correlation between these two measurements indicates that intelligibility was high, or that it was possible to grasp a great deal of local and global information (or of the structure as a whole) by walking along streets. Looking at the respective axial maps of these two decades, it is possible to notice that the lines of the formal grid were still dominant in the informally produced areas, since many long lines had been extended from the formal grid. This explains the regularity expressed by the high level of correlation of local and global integration (or legibility of 0.8). From the 1970s to the 1980s the street system increased by 34%. Considering the similar levels of integration measurement between the two decades, it is possible to say that such an increase represented an evolution of the original patterns. From the 1980s to the 1990s, the system increased another 33%, due to creation of infill grids, and the values of local integration increased by 1.9 over the same period, while global integration presented a slight decrease. The result was a new correlation between global and local integration, more balanced between the extremes of an excessively regular and a labyrinthine structure (or intelligibility of 0.4), indicating the occurrence of a metamorphosis, through which a vernacular street system acquired a proper identity, differentiated from the formal city grid (Holanda, 1997; Kubat, 1999, Azimzadeh & Klarquist, 2001). Theoretically, a balanced intelligibility suggests that there are clearly defined lines which can allow an outsider to cross the area, as well as intimate areas formed by more segregated lines which are better controlled by inhabitants (Fig 6.12).

The occurrence of official upgrade in the basin during the late 1980s (PMB, 1989,1990), which consisted of building canals and street regularisation and landfill, modified the syntactic values and enhanced the local spatial structure by creating a legible hierarchy of short local streets. The canals have diverted waters and prompted subdivision of existing blocks and the creation of new small grids, intensifying occupation, although this did not promote a better global integration of upgraded areas (the settlements did not become better integrated within themselves; they only became better connected to the most integrated lines of the system). The result in practice was that some interventions allowed outsiders to cross the Tucunduba basin street system in their movements

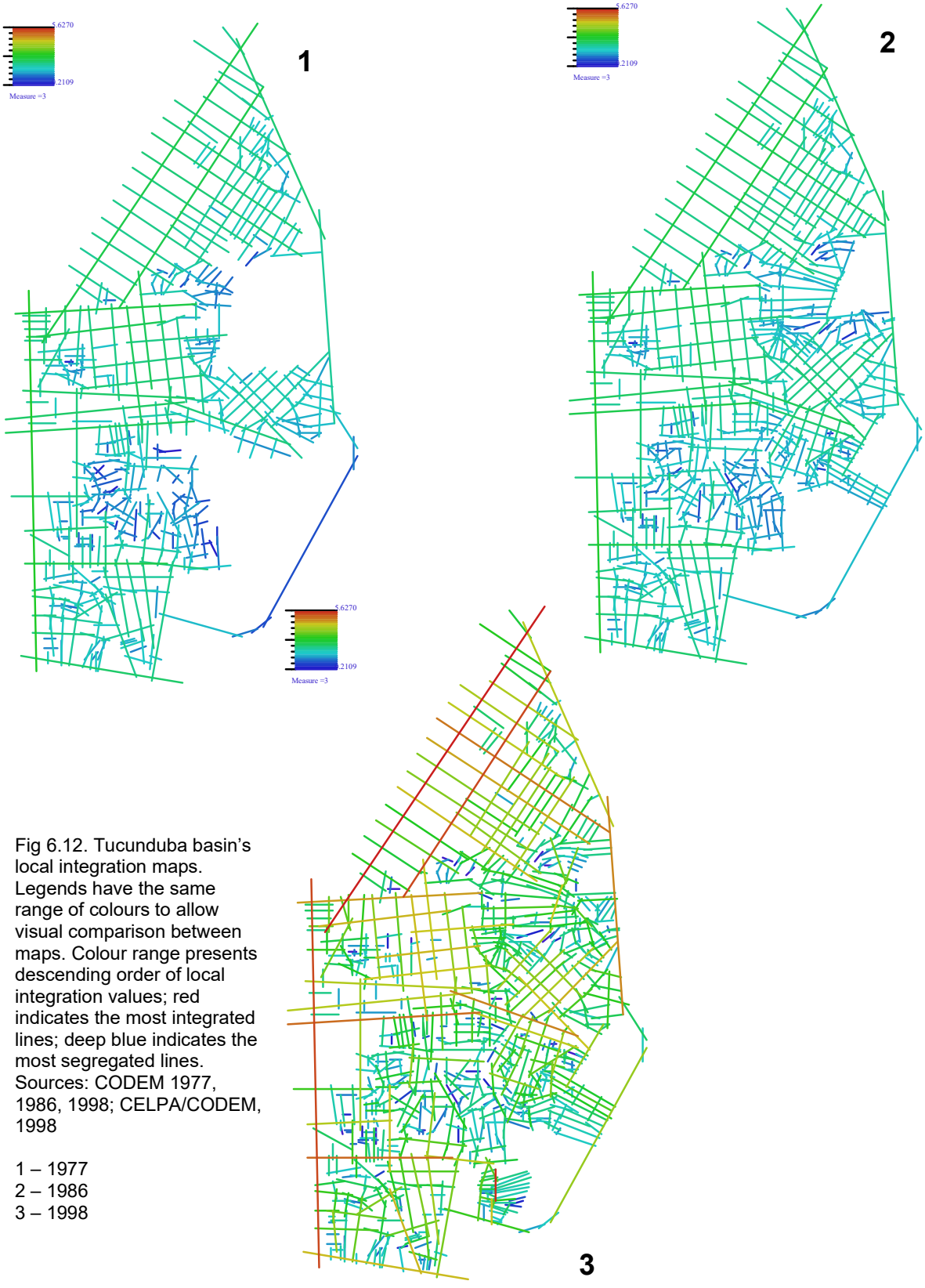


Fig 6.12. Tucunduba basin's local integration maps. Legends have the same range of colours to allow visual comparison between maps. Colour range presents descending order of local integration values; red indicates the most integrated lines; deep blue indicates the most segregated lines. Sources: CODEM 1977, 1986, 1998; CELPA/CODEM, 1998

1 – 1977
2 – 1986
3 – 1998

between the city centre and the institutions located along the ring road. However, this of type of movement is commonly motorised, while inhabitants usually walk and cycle over the area (see tables C1 to C4 presented in Appendix C). This means that, generally, inhabitants are more likely to shop in the area than outsiders; and that in the more integrated streets where commerce is concentrated, the congestion of space limits their attractiveness to motorised consumers, maintaining the local character of the subcentre (Fig 6.12).

The observation of depth has shown that a two-step grid from the two most locally integrated lines[3] has been more or less constant in the three stages of occupation, and that this corresponds to the streets extended from the historic grid. Conversely, the 1970s most segregated lines have become less segregated, depending on their proximity to the two step grid. Lines nine and eight steps deep during the 1970s, located behind the cemetery (in Santa Casa case study area), stabilised at six to four steps deep during the 1980s. The 1970s' nine steps deep lines, located in Tucunduba case study area, became eight steps deep during the 1980s and seven steps deep during the 1990s. In the Santa Cruz case study area, 1970s' seven steps deep lines had a diverse evolution; they became three steps deep when a line was extended further from the formal grid and touched them, but kept their original depth over the following decades when they continued isolated from lines that form two-steps grid of shallower lines[4]. This means that time is not the only variable contributing to enhancement of accessibility; proximity to the most integrated lines also hastens enhancement of depth. The most integrated two-step grid usually corresponds to the streets of mixed use (market, open market, schools, services, shops, etc.) which provide better economic and social opportunities for inhabitants (Fig. 6.13). This confirms one of Hillier's (2000) techniques to identify the process of centrality: i.e., the one that found that the most integrated lines are those which connect the different, otherwise unconnected grids (presented in the box 4.2)

In Paracuri basin, the correlation between global and local integration was R^2 =0.5142 during the 1980s, and fell to R^2 = 0.4584 during the 1990s, after a system size increase of 1.5. The present correlation still expresses a balanced relationship between a regular and a labyrinthine structure, where the longest lines are provided by the historic formal grid (Holanda, 1997, Kubat, 1999) (Table 6.2). At present, the intelligibility of the space is higher for the inhabitant than for the visitor, and the

[3] Two lines were selected as a reference to depth maps because of the configuration of the system. These two lines interconnected the basin with the formal grid; the one northwards is the second most integrated line of the city street system, and the one southwards is among the 70% most integrated lines of the city system, and where the main subcentre of the basin is located.

[4] If the depth point map is calculated by taking the ring road as a starting point, the most segregated areas in Santa Cruz are eight steps deep, showing that they actually form a pocket of segregated lines in the middle of the basin.

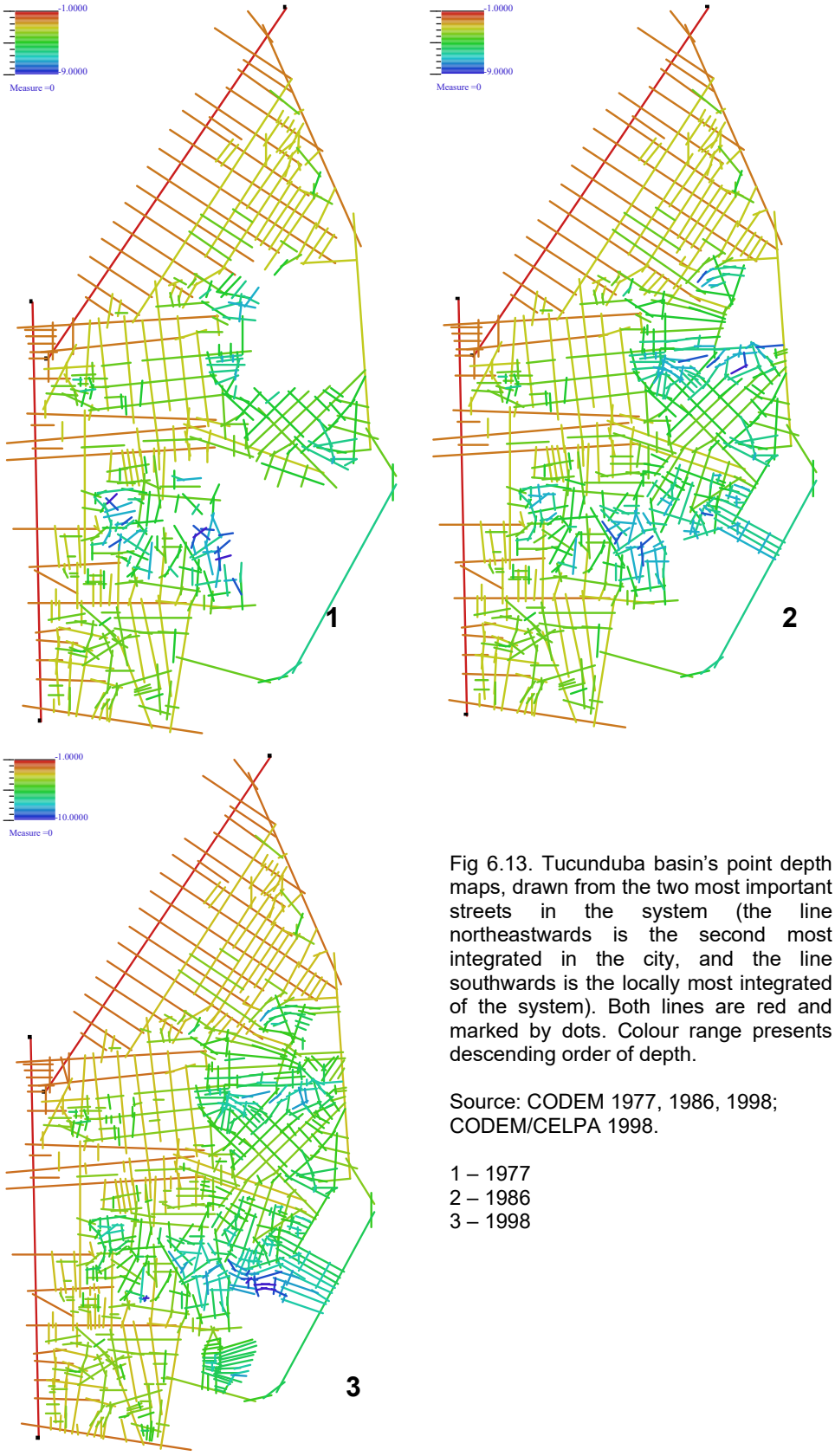
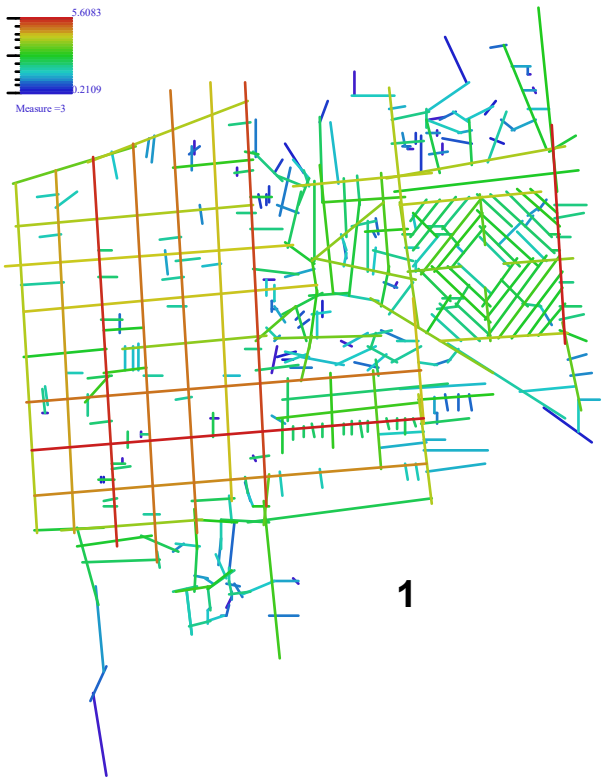


Fig 6.13. Tucunduba basin's point depth maps, drawn from the two most important streets in the system (the line northeastwards is the second most integrated in the city, and the line southwards is the locally most integrated of the system). Both lines are red and marked by dots. Colour range presents descending order of depth.

Source: CODEM 1977, 1986, 1998; CODEM/CELPA 1998.

1 – 1977
2 – 1986
3 – 1998



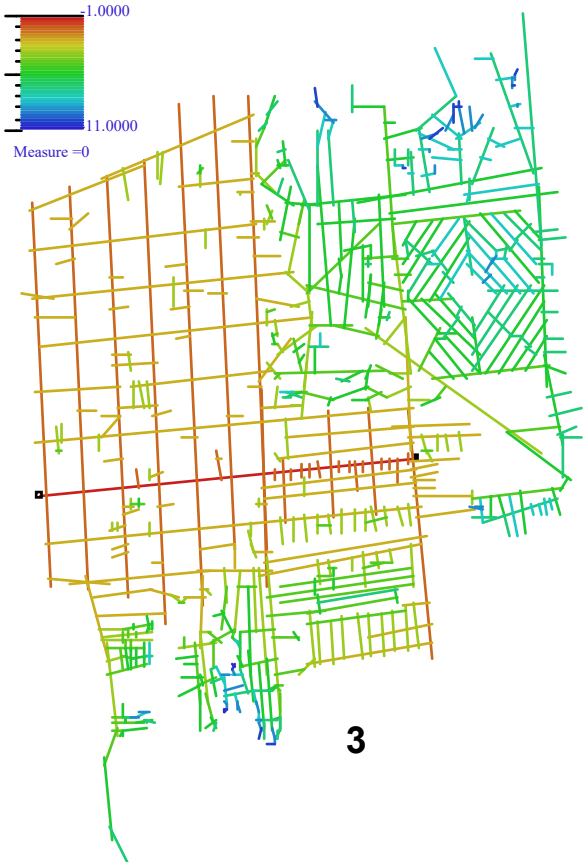


Fig 6.14. Paracuri basin's maps. Sources: CODEM 1986, 1998; CELPA/ CODEM, 1998). Colour ranges present descending values for all measurements.

1 – 1980s local integration (r3)
2 – 1990s local integration (r3)
3 – point depth, drawn from the most locally integrated line (marked with black dots)

two-step grid does not penetrate into the informal settlements to the same extent as it does in the city centre. The case study areas, particularly, constitute a system edge. During the 1980s the range of depth of Paracuri's lines was four to eleven steps from the system's locally most integrated line. During the 1990s, both areas were at least three steps from the locally most integrated line and the range of depth varied by up to nine steps in Paracuri and up to eight in Arthur Bernardes. This indicates a process similar to Tucunduba basin's occupation in terms of grid infilling (depth evolution) over time, and faster (positive) change in the depth of lines closest to the two-step grid (Fig. 6.14).

Table 6.2. **Case study areas' syntactic measurements by time of formation**

Zone	City Centre - Tucunduba basin			Expansion area - Paracuri basin		
Time	1970s	1980s	1990s	1970s	1980s	1990s
R^2	0.8087	0.8139	0.4058	-	0.5142	0.4584
Integration Rn	2.3960	2.2778	2.2341	-	2.1262	2.0568
Integration R3	2.9919	2.9431	5.6270	-	5.6083	5.6759

6.3.2. Cross-tabulation between syntactic measurements and socio-economic variables

Global and local integration levels were put into descending order of integration and tabulated in decile bands (1 represents the 10% most integrated lines and 10 the last decile of integration, or the 10% most segregated lines) in order to compare case study syntactic measurements and to make cross-tabulations with other variables. Both spatial and socio-economic variables were entered into a database having the household as its key.

Tables 6.3 to 6.5 show how global integration, local integration and depth (calculated from the most locally integrated line of the system) vary according to location. Table 6.3 shows that the case study areas may be differentiated according to global integration into three groups, the most integrated, represented by Control 1 (with 4 as the most frequent range of global integration); the intermediate, represented by Paracuri (with 6 as the most frequent range of global integration); and the slightly segregated, constituted by all the other areas (with 7 as the most frequent range of global integration). Local integration also defines three groups (Table 6.4), the most integrated, corresponding to Control 1 (with 4 as the most frequent range of local integration); the intermediate, constituted by Santa Cruz, Paracuri, and Control 2 (with 5 as the most frequent range of local integration); and the slightly segregated, constituted by Santa Casa, Tucunduba and Arthur Bernardes (with 7 as the most frequent range of local integration). In Santa Casa and Santa Cruz, the most frequent depth is five steps from the lines of origin (Table 6.5). Control 1 has the shallowest (most frequent depth is three steps from the lines of origin) and Tucunduba the deepest situation regarding depth (most frequent depth is seven steps from the lines of origin). In Paracuri

basin, the most frequent depth is the same as in Paracuri and Arthur Bernardes case studies (five steps from the line of origin) and the Control 2 has the deepest situation (six steps from the line of origin) because of the official settlement values (modes are shown in bold in the tables).

Table 6.3. **Global integration versus location** (percentages)

	Tucunduba basin – city centre				Paracuri basin – expansion area		
Integ Rn	S Casa	S Cruz	Tucunduba	Control 1	Paracuri	A Bernardes	Control 2
1	-	-	-	12.8%	3.3%	-	-
3	-	-	-	20.5%	-	-	23.5%
4	-	2.4%	2.3%	**23.1%**	13.3%	4.2%	5.9%
5	8.8%	19.5%	-	20.5%	-	-	-
6	17.6%	19.5%	7.0%	17.9%	**33.3%**	16.7%	-
7	**41.2%**	**51.2%**	**41.9%**	-	26.7%	**50.0%**	**64.7%**
8	23.5%	7.3%	34.9%	5.1%	23.3%	25.0%	5.9%
9	8.8%	-	14.0%	-	-	4.2%	-
Total	100%	100%	100%	100%	100%	100%	100%

Note: Global integration values (Integ. Rn) are shown in table 5.1; here the column Integ Rn had decile ranges replaced by absolute numbers

Table 6.4. **Local integration versus location** (percentages)

	Tucunduba basin – city centre				Paracuri basin – expansion area		
Integ R 3	S Casa	S Cruz	Tucunduba	Control 1	Paracuri	A Bernardes	Control 2
1	-	-	-	-	3.3%	-	-
2	-	-	-	25.6%	-	-	-
3	5.9%	4.9%	4.5%	12.8%	-	-	-
4	5.9%	19.5%	-	-	13.3%	8.3%	23.5%
5	8.8%	22.0%	9.1%	**41.0%**	13.3%	12.5%	-
6	11.8%	**36.6%**	13.6%	7.7%	**43.3%**	20.8%	**64.7%**
7	**32.4%**	9.8%	**38.6%**	7.7%	-	**37.5%**	11.8%
8	26.5%	7.3%	20.5%	-	6.7%	8.3%	-
9	-	-	6.8%	-	20.0%	12.5%	-
10	8.8%	-	6.8%	5.1%	-	-	-
Total	100%	100%	100%	100%	100%	100%	100%

Note: Local integration values (Integ. R3) are shown in the table 5.2. Here the column Integ R3 had decile ranges replaced by absolute numbers

Table 6.5. **Depth versus location** (percentages per column)

	Tucunduba basin – city centre				Paracuri basin – expansion area		
Depth	S Casa	S Cruz	Tucunduba	Control 1	Paracuri	A Bernardes	Control 2
2	-	-	-	30.8%	6.7%	-	-
3	2.9%	-	2.3%	**46.2%**	10.0%	4.2%	23.5%
4	20.9%	29.3%	4.5%	17.9%	23.3%	16.7%	5.9%
5	**44.1%**	**48.8%**	20.5%	5.1%	**36.7%**	**54.2%**	-
6	20.6%	19.5%	27.3%	-	20.0%	20.8%	**70.6%**
7	11.8%	2.4%	**29.5%**	-	-	4.2%	-
8	-	-	15.9	-	3.3%	-	-
Total	100%	100%	100%	100%	100%	100%	100%

Note: Depth value is the actual number of steps that each line is from the most locally integrated line in the system

Tables 6.6 and 6.7 show the cross-tabulation between longest individual schooling years and highest individual income per household in Tucunduba and Paracuri basins. Table 6.7 shows that

low income, three MW (minimum wages) and below, and education between eight to eleven years (eight years to complete fundamental education, eleven years to complete intermediate education) are the mode (recurring with highest frequency) of these variables in Tucunduba basin. This table shows that individual income follows individual schooling and vice-versa (both variables are represented here by the highest occurrence in the household), confirming the correspondence between income and education observed in Belém by Lima (2000) and PEMAS (2001). This also indicates that despite living in informal settlements, Tucunduba's inhabitants easily take part in the formal economy, as observed in Browder's and Godfrey's (1997) studies on informal settlements located in the Amazon region, one of them in the state where Belém is the capital.

Table 6.6. **Percentages of the highest individual income within a household against the longest individual schooling within a household in the city centre** (99.4% of interviewees answered this question) Inclusive Controls

Schooling Income	illiterate	Up to 4 years	4 – 8 years	8 – 11 years	+ 11 years	Total
Up to 1 MW	100%	**42.9%**	22.2%	12.8%	6.9%	15.2%
1 – 3 MW	-	28.6%	**44.4%**	**44.7%**	10.3%	**37.3%**
3 – 5 MW	-	-	7.4%	13.8%	3.4%	10.1%
5 – 10 MW	-	-	7.4%	10.6%	**31.0%**	13.3%
+ 10 MW	-	-	-	1.1%	27.6%	5.7%
Uncertain	-	28.6%	14.8%	16.0%	6.9%	14.6%
None	-	-	3.7%	-	3.4%	1.3%
Not informed	-	-	-	1.1%	10.3%	2.5%
Total	100%	100%	100%	100%	100%	100%

Table 6.7 shows that the modes for highest individual income are uncertain or unpredictable and for longest individual schooling years is between eight and eleven years in Paracuri basin[5]. In Paracuri, more education also indicates a higher level of income among individuals in a household, but not as outstandingly as in the city centre. In the next sections these two variables are cross-tabulated to the syntactic measurements to investigate possible patterns of correspondence between spatial attributes and socio-economic data.

Table 6.7. **Percentage of highest individual income within a household against the longest individual schooling within a household in the expansion area** (95.9% of interviewees answered this question) Including Control 2

	illiterate	Up to 4 years	4 – 8 years	8 – 11 years	+ 11 years	Total
Up to 1 MW	-	**62.5%**	24.0%	8.3%	-	20.0%
1 – 3 MW	-	12.5%	28.0%	**36.1%**	**100%**	31.4%
3 – 5 MW	-	-	-	16.7%	-	8.6%
5 – 10 MW	-	-	-	2.8%	-	1.4%
+ 10 MW	-	-	-	-	-	-
Uncertain	-	12.5%	**48.0%**	30.6%	-	**34.3%**
None	-	12.5%	-		-	1.4%
Not informed	-	-	-	5.6%	-	2.9%
Total	-	100%(11.4%)	100%(35.7%)	100%(51.4%)	100%(1.4%)	100%

[5] Percentage of total to longest individual schooling years are presented in brackets in the total row of Table 6.7.

6.3.2.1. Physical access to education

Tables 6.8 and 6.9 show patterns similar to the cross-tabulation of longest schooling years against local integration in city centre and the expansion area. In both areas, longest schooling years are distributed over all percentages of local integration, and have their mode in the same range of values, as reported by Hillier et al (2000) for informal settlements in Santiago, suggesting that space does not interfere with inhabitant's access to education. Nevertheless this is a partial result, since Tables 6.10 and 6.11 show that, despite the quantitative similarities, there are differences in qualitative terms in physical access to school. Such differences are translated into different times of journey from house to school, and what this journey might imply in transport costs.

Table 6.8. **Longest individual schooling years within a household against local integration**. City centre (99.4% of interviewees answered this question). Absolute numbers in brackets.

Integ R 3	Illiterate	Up to 4 years	4 – 8 years	8 – 11 years	+ 11 years	Total
2	-	-	3.7% (1)	5.3% (5)	13.8% (4)	6.3%
3	-	-	3.7% (1)	9.6% (9)	3.4% (1)	7.0%
4	-	14.3% (1)	3.7% (1)	7.4% (7)	3.4% (1)	6.3%
5	**100% (1)**	14.3% (1)	11.1% (3)	14.9% (14)	**44.8% (13)**	20.3%
6	-	14.3% (1)	7.4% (2)	**23.4% (22)**	10.3% (3)	17.7%
7	-	28.6% (2)	**40.7% (11)**	20.2% (19)	10.3% (3)	**22.2%**
8	-	28.6% (2)	18.5% (5)	12.8% (12)	6.9% (2)	13.3%
9	-	-	3.7% (1)	1.1% (1)	3.4% (1)	1.9%
10	-	-	7.4% (2)	5.3% (5)	3.4% (1)	5.1%
Total	100% (1)	100% (7)	100% (27)	100% (94)	100% (29)	100%

Table 6.9. **Longest individual schooling years against local integration**. Expansion area (95.5% of interviewees answered this question). Absolute numbers in brackets.

Integ R 3	Illiterate	Up to 4 years	4 – 8 years	8 – 11 years	+ 11 years	Total
1	-	-	-	2.8% (1)	-	1.4%
4	-	12.5% (1)	12.0% (3)	16.7% (6)	-	14.3%
5	-	12.5% (1)	8.0% (2)	11.1% (4)	-	10.0%
6	-	**37.5% (3)**	**36.0% (9)**	**41.7% (15)**	**100% (1)**	**40.0%**
7	-	-	28.0% (7)	11.1% (4)	-	15.7%
8	-	25.0% (2)	4.0% (1)	2.8% (1)	-	5.7%
9	-	12.5% (1)	12.0% (3)	13.9% (5)	-	12.9%
Total	-	100% (8)	100% (25)	100% (36)	100% (1)	100.0%

Table 6.10. **Time of journey from house to school by case study area** (36.1% of interviewees answered this question)(33.7% of the interviewed were full-time students)

Time	City Centre – Tucunduba basin				Expansion area – Paracuri basin		
(minutes)	Control 1	S Casa	S Cruz	Tucunduba	Paracuri	A Bernardes	Control 2
Up to 10	49.2%	53.7%	41.4%	31.1%	63.3%	47.6%	67.7%
11 – 20	32.8%	35.4%	48.6%	46.2%	30.6%	38.1%	16.1%
21 – 45	18.0%	11.0%	10.0%	20.8%	-	4.8%	6.5%
+ 45	-	-	-	1.9%	6.1%	9.5%	9.7%
Total	100%	100%	100%	100%	100%	100%	100%

Table 6.11. **Means of transport from house to school by case study area** (37.2% of interviewees answered this question)

Means	City Centre – Tucunduba basin				Expansion area – Paracuri basin		
	Control 1	S Casa	S Cruz	Tucunduba	Paracuri	A Bernardes	Control 2
On foot	44.3%	78.3%	67.6%	64.2%	54.5%	38.1%	75.8%
Bus	42.5%	16.9%	25.7%	29.2%	7.3%	19.0%	9.1%
Bicycle	-	4.8%	6.8%	5.76%	38.2%	45.9%	15.2%
Car	13.1%	-	-	-	-	-	-
Motocycle	-	-	-	9%	-	-	-
Total	100%	100%	100%	100%	100%	100%	100%

Journey on foot is the best choice in city centre case study areas, which are contrasted with the values presented for Control 1. In the expansion area, invasions and the control area have similar patterns, although Arthur Bernardes' values for journeys by bicycle are higher than of those on foot. The time taken by journeys suggests that distances are longer for expansion area inhabitants and for Tucunduba, where they surpass 45 minutes. This may be due to a combination of less costly (and slower) means of transport and longer distances, or to inhabitants' preference for schools located in other districts, as mentioned in interviews. The latter is indicative of occupation conditions (associated with density patterns and infrastructure quality) having a great deal of importance for quality of educational access. In Belém's context of scarcity, the provision of social and physical infrastructure in the expansion area is constrained by the isolation of the old village in relation to the city centre, and of the informal settlements in relation to the existing occupation in the expansion area. The discontinuity of occupation and the homogeneity of socio-economic conditions delay qualitative improvements in both types of infrastructure.

Higher values, that is 11-20 minute journeys in Santa Cruz and Tucunduba, may be a consequence of their deepest position among city centre locations. They are also the areas where the bus is the second most-used means of transport, perhaps because it is not as safe to cycle in these areas as it seems to be in the expansion area, or because there is a better bus service within the Tucunduba basin. The interviews showed complaints about lack of safety due to criminality and to traffic increase within the city centre. Once more, evidence is inconclusive and indicates that occupation conditions may offer further explanations about movement in public space.

6.3.2.2. Physical access to income

Tables showing the highest income within households against local integration in the city centre and the expansion area are more diverse (Tables 6.12 and 6.13). The cross-tabulation between local integration and highest income per household shows that labour with fixed income is more usual in the city centre than in the expansion area. The income band of one up to three minimum wage (hereafter MW) is the most frequent, and it is distributed over all local integration deciles, although it is more concentrated between the intermediate range of 5th up to 8th deciles for local integration.

Incomes in the band of five up to 10 MW, and more than 10 MW, are more frequent in the 5th decile of local integration. Hence, it might be possible to say that upper income households (who can afford individual houses) prefer medium integration deciles, protected from external traffic but not too far from it, with clearer definition of gradients between public and private spaces (Calliandro,1991:159). Uncertain and unpredictable income begins to be found from the 3rd decile of street local integration upwards.

Table 6.12. **Highest individual income within a household against local integration**. City centre (99.4% of interviewees answered this question)). Absolute numbers in brackets.

Integ R 3	Up to 1 MW	1 – 3 MW	3 – 5 MW	5 – 10 MW	+ 10 MW	Uncertain	None	Not informed
2	8.3 % (2)	3.4 % (2)	12.5 %(2)	9.5 % (2)	-	-	-	**50 %(2)**
3	8.3 % (2)	6.8 % (4)	6.3 % (1)	4.8 % (1)	11.1 %(1)	8.7 % (2)	-	-
4	12.5 %(3)	3.4 % (2)	6.3 % (1)	4.8 % (1)	-	13.0 %(3)	-	-
5	8.3 % (2)	16.9 %(10)	25.0 %(4)	**38.1 %(8)**	**66.7 %(6)**	8.7 %(2)	-	-
6	**25.0 %(6)**	13.6 % (8)	**31.3 %(5)**	14.3 %(3)	-	**21.7 %(5)**	-	25 %(1)
7	**25.0 %(6)**	**30.5 %(18)**	12.5 %(2)	9.5 % (2)	-	17.4 %(4)	**100 %(2)**	25 %(1)
8	8.3 % (2)	18.6 %(11)	6.3 % (1)	4.8 % (1)	22.2 %(2)	17.4 %(4)	-	-
9	-	3.4 % (2)	-	-	-	4.3 % (1)	-	-
10	4.2 % (1)	3.4 % (2)	-	14.3 %(3)	-	8.7 % (2)	-	-
Total	100 %(24)	100 %(59)	100 %(16)	100 %(21)	100 %(9)	100 %(23)	100 %(2)	100 %(4)

Table 6.13 shows highest income household against local integration in the expansion area. It highlights informal work and the prevalence of 1 to 3 MW of income. It also points to the absence of information about income until the 4th decile of local integration is reached. The maximum income band is 5 MW to 10 MW. The existence of low income households at all deciles of local integration demonstrates that verification of other variables may be necessary to provide conclusive evidence about the relationship between spatial attributes and access to income.

Table 6.13. **Highest income within a household against local integration**. Expansion area (95.9% of interviewees answered this question)). Absolute numbers in brackets.

Integ R 3	Up to 1 MW	1 – 3 MW	3 – 5 MW	5 – 10 MW	+ 10 MW	Uncertain	None	Not informed
1	-	-	-	-	-	-	-	50% (1)
4	7.1% (1)	18.2% (4)	33.3% (2)	-	-	12.5% (3)	-	-
5	-	13.6% (3)	-	-	-	16.7% (4)	-	-
6	**35.7% (5)**	**31.8% (7)**	**50.0% (3)**	-	-	**50.0%(12)**	-	50% (1)
7	28.6% (4)	18.2% (4)	-	100% (1)	-	8.3% (2)	-	-
8	7.1% (1)	4.5% (1)	-	-	-	4.2% (1)	100% (1)	-
9	21.4% (3)	13.6% (3)	16.7% (1)	-	-	8.3% (2)	-	-
Total	100% (14)	100% (22)	100% (6)	100% (1)	-	100% (24)	100% (1)	100% (2)

Investigation of household size has demonstrated that households with more than10 inhabitants occur in integrated, intermediary and segregated local integration levels in the city centre. Conversely, the most segregated intervals of integration within the city centre are more frequent when households have about five to nine inhabitants. In the expansion area, the 10% most

integrated streets have between two and four inhabitants per household (represented in the table by the range three – five inhabitants), and all other local integration bands have households with one to six inhabitants. Nine to eleven inhabitant households live between the 4th and 6th deciles of local integration (Tables 6.14 and 6.15).

Table 6.14. **Household size against local integration**. City centre (99.4% of interviewees answered this question)

	2	3	4	5	6	7	8	9	10	Total
0 - 1	-	-	10%	3.1%	3.6%	-	-	-	-	1.9%
2	-	9.1%	-	3.1%	3.6%	8.6%	14.3%	-	-	5.7%
3 – 5	**60.0%**	**54.6%**	**60.0%**	**53.1%**	**57.1%**	**57.2%**	**47.6%**	**66.7%**	**62.5%**	**55.7%**
6 – 9	20.0%	36.4%	20.0%	34.4%	28.6%	31.5%	23.8%	-	25%	28.5%
10 – 12	20.0%	-	-	6.2%	-	2.9%	4.8%	33.3%	12.5%	5.7%
13 – 19	-	-	10.0%	-	3.6%	-	9.6%	-	-	2.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.15. **Household size against local integration**. Expansion area (95.4% of interviewees answered this question)

	1	4	5	6	7	8	9	Total
0 - 1	-	-	-	10.7%	9.1%	-	11.1%	4.3%
2	-	10%	-	7.1%	9.1%	25%	11.1%	2.9%
3 – 5	**100%**	**80%**	**71.5%**	**67.8%**	**72.8%**	**75%**	**44.4%**	**68.7%**
6 – 9	-	10%	14.3%	10%	9.1%	-	33.3%	12.8%
10 – 12	-	-	14.3%	3.6%	-	-	-	2.8%
13 – 19	-	-	-	-	-	-	-	-
Total	100%	100%	100%	100%	100%	100%	100%	100%

This suggests that bigger households may have more breadwinners and a higher household income in the city centre, but when just one or two people are responsible for many others (there is a case of one low paid worker supporting 11 inhabitants), poverty pushes them to more segregated locations. Within the expansion area, the pattern is different; smaller households are more integrated, but the biggest households are not the most segregated, suggesting that household size may help in achievement of better locations. The ratio of workers to non-workers per household was calculated in order to explore household size further.

Households where most inhabitants work (ratio of workers to non-workers between 0.76 and 1) are the most frequent in the most integrated interval of local integration (2nd decile); they are also well represented in intermediate levels. Households where half the occupants work are the mode of this variable (43.8% of the sample); they are better represented in intermediate levels of integration, but occur at all levels. Households where most inhabitants depend on only a few workers occur at all levels, but are most frequent at the most segregated level of integration (10th decile) (Table 6.16).

Table 6.16. **Ratio of workers to non-workers against local integration**. City centre (99.4% of interviewees answered this question)

	2	3	4	5	6	7	8	9	10	Total
0	-	-	-	-	-	2.9%	-	-	-	0.6%
0.1 - 0.25	10%	-	10%	15.7%	10.8%	5.8%	9.6%	-	**50%**	**10.8%**
0.26 – 0.50	30%	45.5%	**60%**	**34.5%**	**42.8%**	**51.6%**	**52.5%**	33.3%	25%	43.8%
0.51 – 0.75	20%	45.5%	20%	30.8%	39.3%	23%	19.1%	33.3%	25%	28.2%
0.76 – 1.0	**40%**	9.1%	10%	18.7%	7.1%	17.1%	19.1%	33.3%	-	15.7%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

In the expansion area, income is entirely absent in the low and intermediate levels of integration. Other ratios are distributed over almost all levels of local integration. The bands of 0.26 to 0.50 and 0.51 to 0.75 workers/inhabitants are higher at intermediate levels. In the expansion area, 20% of the surveyed households have between zero and 0.25 workers per inhabitant, double the percentage of such households in the city centre. This indicates that location may be affected by the number of breadwinners in the household (Table 6.17).

Table 6.17. **Ratio of workers and non-workers against local integration**. Expansion area (95.9% of interviewees answered to this question)

	1	4	5	6	7	8	9	Total
0	-	-	-	7.1%	9.1%	-	-	4.3%
0.1 – 0.25	-	10%	42.9%	17.9%	9.1%	-	11.1%	15.8%
0.26 – 0.50	-	**50%**	42.9%	**42.9%**	**36.4%**	**50%**	**55.5%**	**44.3%**
0.51 – 0.75	100%	20%	14.3%	28.5%	27.3%	25%	22.2%	25.6%
0.76 – 1.0	-	20%	-	3.6%	18.2%	25%	11.1%	10.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Another variable investigated in order to clarify the relationship between spatial attributes and access to income is the length of time for which present households have been settled in the area (Tables 6.18 and 6.19). In the city centre, the 3rd, 4th and 5th most globally integrated deciles have progressively longer times since settliment. The mode of the length of time since household settlement is the 1970s decade, with a progressive decline in the number of new settlers up to the present (all upgrade actions and tenure regularization have started during the 1980s). Local integration shows that the most segregated deciles (9th and 10th) are in pre-1985 and post 1998 settlements. This indicates that time does not always help households to overcome segregated locations; and that there are newcomers who settle in segregated streets.

According to tables 6.18 and 6.19, the intermediate deciles of local and global integration have received a continuous flow of settlers, which has a lower intensity over time, but does not cease. From table 6.12 is possible to observe a tendency of wealthier households to settle in the intermediate deciles of local integration; a comparison between these two pieces of evidence

indicates that some gentrification is happening in the intermediate levels of local and global integration, after physical improvements have taken place.

Table 6.18. **Period of household settlement against local integration**. City centre (98.7% of interviewees answered this question)

	2	3	4	5	6	7	8	9	10	Total
After 1998	-	-	10%	3.1%	7.1%	8.6%	5.0%	33.3%	12.5%	6.4%
1994 – 1997	10%	-	-	9.4%	7.1%	11.4%	-	-	-	6.4%
1990 – 1993	10%	27.3%	20%	3.1%	14.3%	14.3%	10%	-	-	11.5%
1986 – 1989	-	9.1%	10%	3.1%	7.1%	**25.7%**	25%	-	-	12.1%
1982 – 1985	20%	18.2%	20%	21.9%	21.4%	11.4%	10%	-	25%	17.2%
1970 – 1981	**40%**	18.2%	**30%**	**34.4%**	**25%**	22.9%	**40%**	**66.7%**	**50%**	**31.2%**
Before 1970	20%	27.3%	10%	25.0%	17.9%	5.7%	10%	-	12.5%	15.3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.19. **Period of household settlement against global integration**. City centre (98.7% of interviewees answered this question)

	1	3	4	5	6	7	8	9	Total
After 1998	-	-	-	5.3%	4.2%	5.7%	10.7%	12.5%	5.8%
1994 – 1997	20%	-	-	-	12.5%	9.4%	3.6%	-	6.4%
1990 – 1993	20%	-	9.1%	10.5%	12.5%	9.4%	17.9%	12.5	11.5%
1986 – 1989	-	-	9.1%	10.5%	8.3%	13.2%	17.9%	25%	12.2%
1982 – 1985	20%	25%	-	21.1%	16.7%	22.6%	10.7%	12.5%	17.3%
1970 – 1981	20%	**50%**	27.3%	**31.6%**	16.7%	**35.8%**	**32.1%**	**37.5%**	**31.4%**
Before 1970	20%	25%	**54.5%**	21.1%	**29.2%**	3.8%	7.1%	-	15.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

According to table 6.21, the 30% more globally integrated deciles in the expansion area were occupied by 1989, and the most globally segregated interval (90%) was formed during the 1990s. The mode of the period of settlement in the present households against both local and global integration is the middle 1990s (when the Arthur Bernardes settlements were created and after Paracuri's upgrade) (Tables 6.20 and 6.21). All evidence shown in this section is progressively checked against the next sections' findings, in order to establish its reliability.

Table 6.20. **Period of household settlement against local integration**. Expansion area (95.9% of interviewees answered this question)

	1	4	5	6	7	8	9	Total
After 1998	-	20%	28.6%	25%	36.4%	**50%**	11.1%	25.7%
1994 – 1997	-	20%	14.3%	**32.1%**	**45.5%**	-	**44.4%**	**30.0%**
1990 – 1993	-	10%	14.3%	21.4%	9.1%	25%	11.1%	15.7%
1986 – 1989	100%	10%	-	10.7%	-	-	33.3%	11.4%
1982 – 1985	-	10%	-	3.6%	-	25%	-	4.3%
1970 – 1981	-	105	**42.9%**	3.6%	9.1%	-	-	8.6%
Before 1970	-	20%	-	3.6%	-	-	-	4.3%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 6.21. **Period of household settlement against global integration**. Expansion area (95.9% of interviewees answered to this question)

	1	3	4	6	7	8	9	Total
After 1998	-	-	**33.3%**	**28.6%**	30%	21.4%	-	25.7%
1994 – 1997	-	-	16.7%	21.4%	**33.3%**	**42.9%**	100%	30.0%
1990 – 1993	-	-	16.7%	14.3%	23.3%	7.1%	-	15.7%
1986 – 1989	100%	-	-	21.4%	3.3%	21.4%	-	11.4%
1982 – 1985	-	25%	-	7.1%	-	7.1%	-	4.3%
1970 – 1981	-	25%	16.7%	7.1%	10%	-	-	8.6%
Before 1970	-	**50%**	16.7%	-	-	-	-	4.3%
Total	100%	100%	100%	100%	100%	100%	100%	100%

6.3.3. Sub – conclusions to entitlements

This section was dedicated to the assessment of the influence of location, timescale and configuration on the potential of streets to provide access to desired goals or destinations, taken here as spatial entitlements. Location and configuration were investigated through comparisons between case study areas' syntactic measurements; timescale was observed through the time lag between the case study areas' time of origin and comparisons between maps that isolate different moments of settlement evolution in both basins. The three variables were checked against socio-economic variables obtained from questionnaires to refine the spatial evidences.

From the outset, global integration levels indicate that both areas are segregated in relation to the whole city system; however, Tucunduba basin is among the 6th and 7th deciles of global integration Paracuri basin is among the 9th and 10th deciles, among the most segregated lines of the system. As in the context of informal settlements centrality is an important factor in the availability of a diverse range of sources of income, the city centre initially offers better prospects.

Observation of global and local integration measurements of the basins' street system in three moments in time showed that over two decades there was a metamorphosis in Tucunduba's street system. This resulted in the creation of a balanced and well-structured vernacular system after the introduction of new infill grids and upgrade actions, consisting of drainage and street regularisation. In Paracuri basin the street system has only recently evolved; the street system formed by the informal settlements is still peripheral to the formal grid, which is not extensive enough to modify the relationship between the formal and the vernacular street systems.

Observation of evolution of street depth over the same period showed that there is a two step grid more or less constant in the city centre, which has received commercial activities, services and social infrastructure (schools, health centre). Changes in depth in the most segregated lines during the 1970s in Santa Casa and Tucunduba case study areas (from nine to six to four step depth in the former, and from nine to eight to seven in the latter), and maintenance of depth in some of Santa Cruz's most segregated lines, showed that time and proximity to most integrated lines define

decrease of depth, and enhancements in integration (or accessibility conditions). This was confirmed, but with a weaker intensity, in the expansion area.

Cross-tabulation between the syntactic measurements and location (the variable that identifies case study areas) showed that case study areas are divided into three groups of accessibility, where Control 1 has always the best accessibility, Paracuri has always an intermediate level of accessibility, followed by Santa Cruz and Control 2 regarding local integration, and by Santa Casa, Santa Cruz and Arthur Bernardes regarding depth. The Tucunduba case study area always has lower levels of accessibility.

Social variables were introduced at this stage of analysis to check the achievement of life chances against the potential for integration or segregation of space. Cross-tabulations between the highest individual income per household and the longest individual schooling showed that the former follows the latter and vice-versa in the Tucunduba basin. In Paracuri basin the process seems to be the same, but it is not as outstanding as in the city centre. These two social variables were tested against the syntactic measurements to investigate patterns of correspondence between access to education, income and spatial attributes. More results of cross-tabulation of social variables and local integration were presented because they provide clearer results.

Modes for schooling years against local integration showed a distinct differentiation of levels of education in Tucunduba basin according to levels of local integration, and similar trends in the expansion area. Time of journey from house to school and means of transport from house to school qualified the results for each case study area, showing that it takes longer to go to school from Tucunduba and case study areas located in the expansion area, than from Santa Casa and Santa Cruz. This means either the existence of longer distances between house and school, or a search for better standards of education outside the district of origin, and reminds us that homogeneity of socio-economic conditions delays qualitative improvements in social infrastructure.

Cross-tabulation between highest income per household and local integration showed that work with a fixed income is more frequent in Tucunduba basin; upper level income is associated with intermediate levels of local integration, and low income is spread over all the levels of local integration, and is more concentrated between the 5^{th} and 8^{th} deciles of local integration. In Paracuri basin, most of the economically active population has uncertain/unpredictable income (26.1% out of 45.6% in Paracuri; 25% out of 48.6% in Arthur Bernardes; 26% out of 48.9% in Control 2); low income households are present at all deciles of local integration, and upper income people are in the low intermediate levels (6^{th} and 7^{th} deciles) of local integration. Although upper income levels present a clearer pattern in relation to local integration than other income groups, it is not possible

to make conclusive statements about the contribution of space to access to income based only on the relationship between these variables.

Cross-tabulation between household size and local integration showed that in Tucunduba basin five to nine member households are more frequent in intermediate levels of local integration, while ten inhabitant upwards households happen at all levels of local integration. In Paracuri basin three to four households are located in the 1st decile of local integration, while nine to ten member households are located in the 4th and 6th deciles of local integration. This indicates that household size does help in the achievement of better location, but the number of breadwinners needs to be considered in assessing the extent of that achievement.

Cross-tabulation between the ratio of workers to non-workers and local integration confirmed that number of breadwinners is important. In Tucunduba basin ratios of 0.76 up to 1 (meaning that most inhabitants or all inhabitants in a household are workers) are more frequent in the higher levels of local integration, while ratios of 0.1 up to 0.25 (meaning that one or a few workers support many non-workers in the household) occur in all levels, but are more frequent in the lowest levels of local integration. In Paracuri basin there are cases of absence of income, and workers to non-worker ratios of 0.1 up to 0.25 are twice as high as in the city centre.

The period of settlement of the surveyed household showed that, in Tucunduba, settlement was progressive along the 3rd, 4th and 5th deciles of global integration. The period of most intense settlement was the 1970s; since then the rate has progressively decreased. The lowest levels of local integration accompany pre1985 and post 1995 settlement, showing that time alone cannot provide enhancement of local integration levels. Moreover, there are newcomers settling in the most segregated streets and in the intermediate levels of local and global integration physical improvements were made. A comparison of this fact with the tendency of wealthier households to settle in the intermediate levels of local integration indicate that gentrification is happening in the latter.

The results related to Tucunduba basin confirm that the location within the city makes an important contribution to inhabitants' life chances. However, a great deal of this contribution must be associated with configuration, which is more robust in the city centre than in the expansion area. Configuration is responsible for the local dimension of location and interferes with the contribution of time to the process of evolution and consolidation of the case study areas. The association of the three variables creates a responsive space, able to meet the requirements of different social profiles in the city centre. In the expansion area, location affects access to income negatively for the poorest, but the relationship of space with other social variables seems to follow patterns similar to those found in the city centre.

6.4. 'Provision'

Investigations in the previous section have searched for the potential offered by space to physical and socio-economic accessibility. This section searches for the actual means of access offered by space through available spatial provision (e.g. ranging from the availability of streets to the level of infrastructure present on them). Provision searches for physical (either positive or negative) contributions to the potential offered by entitlements.

In order to do this, this section focuses on space generation conditions and infrastructure provision. As explained in Chapters 3 and 4, the action of agents in the production of space have shaped a fringe belt around Belem, which was occupied by huge institutional areas (Conzen, 1969, Whitehand, 2001). This belt was reinforced by the site's physical conditions and the city's impoverishment after World War II. After city growth recovery, this fringe belt began to have its land uses modified in the flooded portions (by invasions of institutional and private property) in an informal and vernacular fashion, due to the local population's economic constraints and the adopted official paradigms (see Chapter 8).

As intensification of occupation occurred informally, there was a change in the process of spatial production in the city. Previously, the expansion areas were marked out according to official plans of alignment; now inhabitants were in charge of the existing grid extension, handling the site's constraints and relying on their spatial knowledge rather than on plans. In order to investigate the process of street generation, the streets within case study areas were classified according to Cannigia's and Maffei's typologies, which describe the process and allows identification of patterns of street production related to inhabitants' spatial knowledge and needs (Marzot, 1998;Cannigia and Maffei, 1995).

Analysis was made through observation of aerial views from the 1970s, 1980s and 1990s and the resultant axial maps (used in the previous section). The investigation aims to identify a pattern of layout evolution and possible links between axial and morphological attributes. The original classification of street types was adapted to the reality of invasion layouts. Primary streets are the only streets existing previous to the settlements' formation; implementation streets are those which are extended from the existing grid; union streets connect implementation streets; and upgrade streets are restructured streets, improved by modification of width and regularization.

For the purpose of this thesis, three other types were added to the original classification. The first new type is the enhanced union street, a union street from which new streets are created (the adjective enhanced was used because this street type's status is enhanced when it assumes characteristics of a primary street, working as a departure point for new streets). From an enhanced street, a second scale grid is created, and for this reason the second type of new street is called a local implementation street, as it is extended as the original implementation streets were. The third type created was the closed street, a street that gives access to the middle of a block of households (Fig. 6.15).

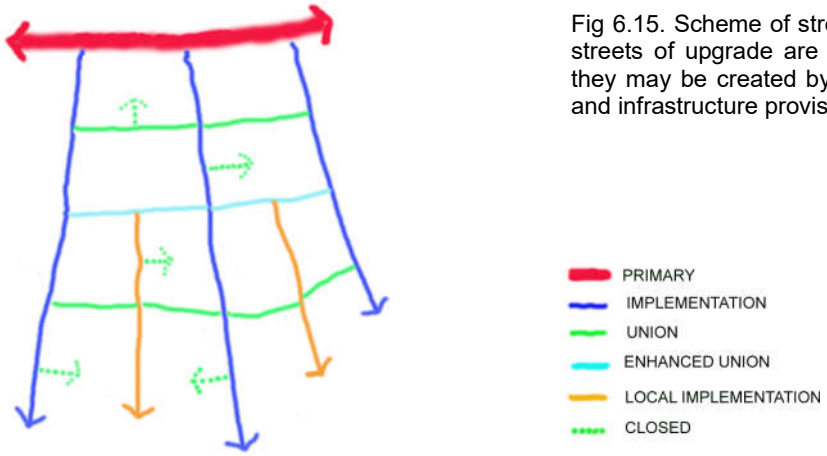


Fig 6.15. Scheme of street types used in this thesis; streets of upgrade are not in the drawing because they may be created by the upgrade (regularisation and infrastructure provision) of any type of street.

6.4.1. Case study areas' typologies

In the Tucunduba basin's case studies, the existing city's grid edge streets were designated as enhanced union streets, while the crossing streets opening towards the river were considered as implementation streets when extended from the city grid, and as local implementation streets when beginning from behind the cemetery. These implementation streets were initially defined by landfill and extended by raised wooden walkways and replaced by landfill afterwards, in a gradual rhythm of consolidation.

In Santa Casa, the main implementation streets were connected by union streets, gradually defined, with convergent directions. Afterwards they were transformed into enhanced union streets, and from those a new step was made towards a deformed grid formation. These streets followed the rhythm of landfill and the water levels. This vernacular layout has resulted in fat blocks which have permitted middle block occupation through the opening of closed streets. This defines a clear hierarchy of streets, and has allowed the maximum use of available space (Fig. 6.16 – 1). The transition between the public spaces, associated with the avenues extended as implementation

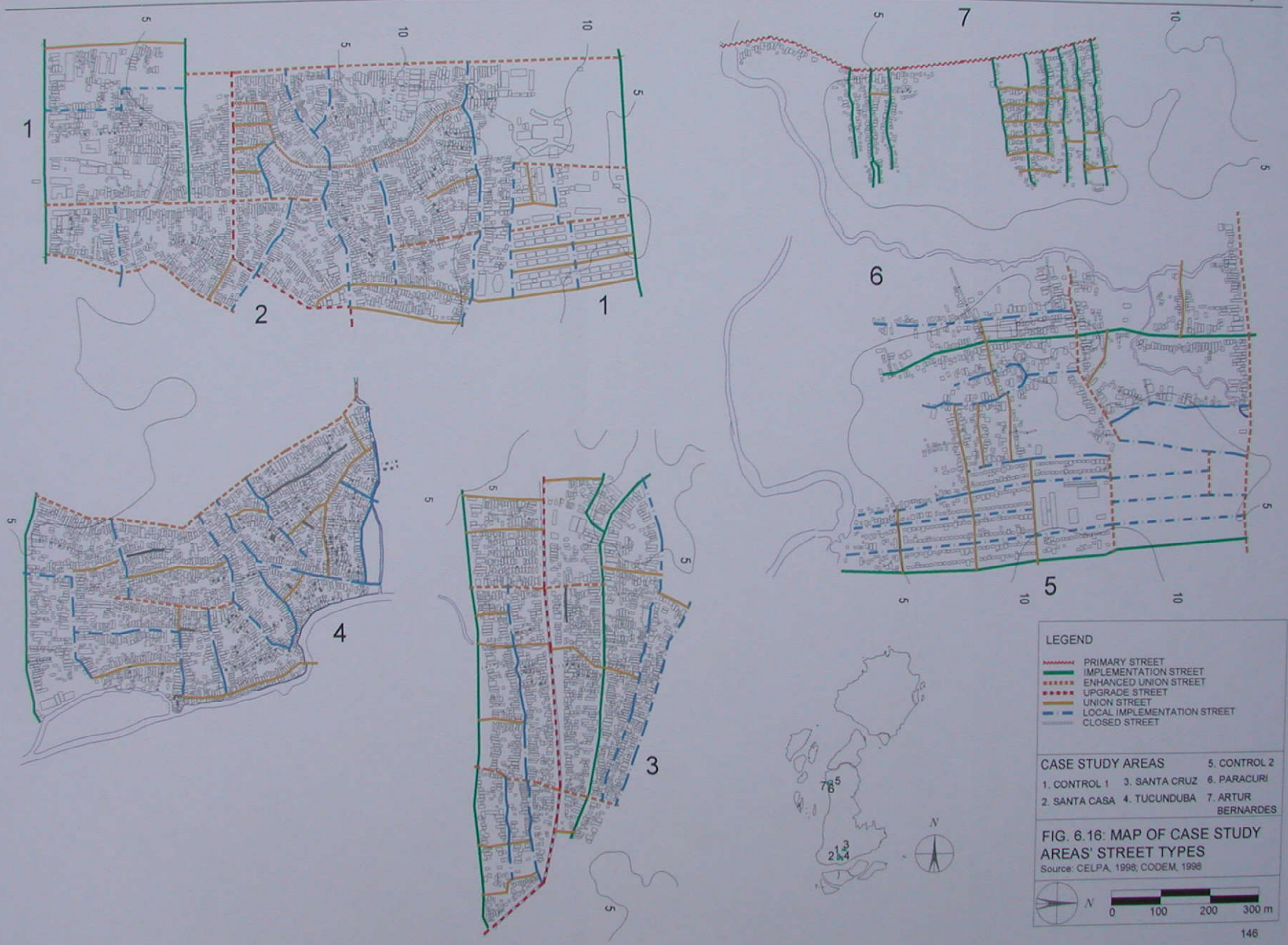


FIG. 6.16: MAP OF CASE STUDY AREAS' STREET TYPES
Source: CELPA, 1998; CODEM, 1998

streets, the semi-public spaces of union streets, the semi-private space of closed streets, and the private space of the house, is part of a structure gradually established over time. Such structure favors heterogeneity of activities, occurrence of social interaction, and more social references and economic opportunities for inhabitants.

Tucunduba's occupation was simultaneous with Santa Casa's lower areas' occupation. Tucunduba's proximity to the river has created an initially different character; inhabitants were attracted by the landscape and the river navigation possibility. The longer implementation streets from Santa Casa area reached the river, defining main axes of occupation; Tucunduba's edge was limited eastwards by an enhanced union street, from where local implementation streets were created, following a pattern similar to that in Santa Casa. Both areas were occupied as edges, leading to the river (Fig. 6.16 - 3). Despite structural similarities Tucunduba is spatially and socially more distant from the city, in terms of potential for social interaction between inhabitants and outsiders than Santa Casa. The avenues that work as implementation streets do not keep the same properties along their length.

In Santa Cruz the implementation streets are the most evident. They are extensions of the city's grid streets, stretching towards the ring road and along water streams that had kept the area permanently flooded for many years. One of the original implementation streets has been upgraded and it divided the area into two halves. The creation of visible union streets was not a priority, since the space between buildings allowed the formation of pedestrian paths (raised wooden walkways) above the flooded ground. Nevertheless two union streets long enough to connect all implementation streets have become enhanced union streets, and present movement above average, confirming a trend already observed in Santa Casa and Tucunduba towards enhanced centrality in the streets which are embedded in new infill grids. After landfill and street drainage, a deformed grid became visible; the resultant blocks are fat and long and are still in the process of subdivision. Closed streets' conditions are generally precarious, as middle blocks are usually flooded (Fig 6.16 - 2). Contrasts are strong in the structure of Santa Cruz. After the upgrading of the implementation streets, these were differentiated by the condition of extensions to existing avenues in the formal grids, to which small union and closed streets are open. The need for open spaces made the avenues communitarian rather than public spaces (as presented in the section 6.5), and changes in the previously homogeneous occupation are starting to be shown through changes in buildings' typologies and materials, but more noticeably in the surroundings of the formal grid.

Paracuri basin is located south of the existing historic village; the grid edge street is taken to be an enhanced union street. One extended implementation street advances and constitutes the main axis of the informal settlement; it is enlarged from a second enhanced union street. The site is

higher and street landfill within the area was hastened. Union streets connect the implementation and local implementation streets with the river bank and the official settlement. The resultant blocks are thinner than those in the city centre, usually with a width of 50 m, not very different from the official settlement ones. The process of block subdivision happens on a different scale; a local implementation street is used to subdivide an existing block and extend the settlement, as there is plenty of territory and blocks are still unevenly occupied along their length (Fig. 6.16 - 4). This configuration is different from the city centre case study areas, to the extent that it relies on only one main connection to the formal grid. The occurrence of upgrading has changed streets' physical conditions rather than dimensions, and differentiation of previous homogeneity is centrifugal, from the middle towards the edges, with a good definition of transition between the public and private spaces. However, in this case study area, the public space is not as intensively used by outsiders as it is in other areas, and therefore economic opportunities and social interaction between different social groups are more restricted.

Arthur Bernardes' settlements have been shaped by implementation streets originating in the main road (a primary street that connects the city and the old village) and also leading towards a river. Most union streets are raised wooden walkways and the resultant grid has blocks with a width and a length of around 40 m and 50 m respectively, in a very homogeneous fashion. This seems to be an exception if compared to those in other case study areas: differences may be due to the settlement's size and stage of consolidation (Fig, 6.16 – 5). The road is a very exposed space to outsiders, which favours commercial activities, but also makes transition between gradients of space quite abrupt. The internal streets are differentiated along their length, assuming a more communitarian character close to the road, and becoming more private towards the edge.

Arthur Bernardes settlements are examples of typical recent occupations in Belem's expansion area, wherein official and informal settlements are disconnected from their surroundings. These new settlements are experiencing a different process of consolidation from the oldest case ones. The former remain quite isolated, while the latter tend to aggregation and have formed bigger areas, recognised as formal districts. Lima (2000) has presented the lack of secondary links between different parts of Belem's periphery as a cause of its spatial fragmentation and accessibility problems on city-wide and intra-periphery scales (p.157). However, in morphological terms, Arthur Bernardes' initial blocks are comparable to the subdivided blocks of Tucunduba basin, which took a long time to be shaped.

6.4.2. Comparisons between morphological variables and syntactic measurements

Correlations between type of street and depth has shown that within Tucunduba's case study areas, streets two steps way from the most locally integrated streets are always implementation streets. The majority of streets three steps depth from the same reference point are union streets; the majority of streets of four steps depth are of local implementation and upgrade; from five steps depth onwards, none of the types is dominant. The correlation between depth and type of street suggests two main sequences of type of street differentiated by depth, (first sequence: implementation, union, local implementation; second sequence: enhanced union, local implementation, closed street). These define two scales of grid. The connection between these grids of different scale is through an enhanced union street that usually is an outstanding street in terms of frequency of pedestrian use in relation to its surroundings, due to its capacity to embed new grids into the existing layout (Hillier et al. 2002). It once more follows Hillier's (2000:113) principle, that streets that connect different grids have a higher potential of centrality. The morphological classification has spotted these streets on a tiny scale which is not identifiable by depth measurement (taking the local most integrated street as the first step), since small interconnected grids often are quite deep (Table 6.22).

The characterisation of different grid scales according to depth describes how the formation and extension of this vernacular street system follows series of infill grids and creates diverse scales of centrality which deliver different economic and social opportunities to inhabitants. The process of subdivision of blocks and plots follows the potential of street accessibility. Progressive depth, in relation to the city's formal grid, creates more homogeneity, and usually coincides with lower levels of official investment in either site upgrade or infrastructure provision.

Table 6. 22. **Type of street against depth**. City centre.

	2	3	4	5	6	7	8	Total
Implementation	**100.0%**	10.0%	7.1%	17.4%	11.1%	-	-	17.1%
Union	-	**65.0%**	7.1%	19.6%	18.5%	27.8%	27.8%	22.2%
Local implementation	-	-	46.4%	**32.6%**	**44.4%**	**55.6%**	55.6%	33.5%
Enhanced union	-	20.0%	7.1%	19.9%	18.5%	16.7%	16.7%	12.0%
Closed	-	5.0%	-	10.9%	7.4%	-	-	7.0%
Up grade	-	-	32.1%	8.7%	-	-	-	8.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Paracuri case study areas have a more confused correlation between type of street and depth, perhaps because of the differences between the two case study areas. In Arthur Bernardes, the sequence of street type is primary, implementation and union, from three to nine steps of depth, where implementation streets have the bigger range of depth, confirming that they cross the whole settlements. In the Paracuri case study area, local implementation streets are still extending the

settlement, which suggests a sequence of implementation, enhanced union and local implementation streets (Table 6.23).

The variation of depth along the same type of street indicates an occupation which is route-oriented. The two types of implementation street dominate and expand the settlements, reflecting a structure of linear movement and perhaps bigger distances and lower potential to create diverse scales of subcentre.

Table 6. 23. **Type of street against depth**. Expansion area.

	2	3	4	5	6	7	8	Total
Primary	-	12.5%	8.3%	-	8.7%	-	-	5.6%
Implementation	100%	12.5%	**58.3%**	**41.7%**	13.0%	100%	100%	35.2%
Union	-	25.0%	-	29.2%	8.7%	-	-	15.5%
Local implementation	-	-	8.3%	16.7%	**65.2%**	-	-	28.2%
Enhanced union	-	**50.0%**	25.0%	12.5%	-	-	-	14.1%
Closed	-	-	-	-	4.3%	-	-	1.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%

The infrastructure counterpart to street layout generation was street landfill, a site improvement which makes occupation feasible. The natural site needed to be transformed to become suitable for urban occupation; however, this transformation has occurred over time. Street condition is taken here as an indicator of infrastructure provision, since pavement is the last step of a sequence of achievements (after landfill and drainage) related to site consolidation. Within Tucunduba's areas, water and electricity are provided, although sewage solutions are individually managed often through septic tanks, when plots are landfilled; in Santa Cruz and Tucunduba pit latrines are frequent in flooded areas. Within Paracuri's areas, only electricity is provided; water is obtained from wells and sewage is individually managed through septic tanks and pit latrines, depending on the plots' physical conditions; however, straight connections from toilets to the river are common next to the river banks. The absence of sanitation contaminates wells and rivers constraining health conditions, fishing and, despite the potential offered by the natural landscape, leisure activities (Oliveira *et al*, 2000).

Correlation between street type and street conditions (Fig 6.17) in the Tucunduba basin has shown that pavement is progressing in all types of street, and is more frequent in implementation streets. Landfill also occurs in all types of street, especially in local implementation streets. Paths are characteristics of union, closed and local implementation streets in process of consolidation. *Estivas* (raisen wooden walkways) also occur when the grid is stretching towards flooded areas. The riverbank street is a narrow street that usually connects the streets which come from higher areas as a longer union street (Table 6.24). Hierarchical potential and depth seem to define a gradual

FIG. 6.17: MAP OF STREET CONDITION

Source: CELPA, 1998; CODEM, 1998

process of street improvement; in other words, improvements occur first in the more important streets.

Table 6.24. **Type of street against street condition**. City centre						
	Paved	Landfilled	Path	*Estivas*	Riverbank	Total
Implementation	**32.8%**	8.8%	-	-	-	17.0%
Union	18.0%	23.8%	14.3%	25.0%	100%	22.6%
Closed	6.6%	6.3%	28.6%	-	-	6.9%
Local implementation	11.5%	**45.0%**	**57.1%**	**75.0%**	-	33.3%
Enhanced union	14.8%	12.5%	-	-	-	11.9%
Up grade	16.4%	3.8%	-	-	-	8.2%
Total	100%	100%	100%	100%	100%	100%

The same correlation in Paracuri basin shows that only the primary street and enhanced union streets are paved. Local implementation streets are landfilled streets and paths (as happens in Paracuri), and implementation streets and union streets may be landfilled streets, paths or *estivas* (as happens in Arthur Bernardes settlements) (Table 6.25)

Table 6.25. **Type of street against street condition**. Expansion area						
	Paved	Landfilled	Path	*Estivas*	Riverbank	Total
Primary	55.6%	-	-	-	-	6.8%
Implementation	-	31.8%	42.9%	80.0%	100%	34.2%
Union	-	15.9%	21.4%	20.0%	-	15.1%
Closed	-	-	7.1%	-	-	1.4%
Local implementation	-	43.2%	14.3%	-	-	28.8%
Enhanced union	44.4%	9.1%	14.3%	-	-	13.7%
Total	100%	100%	100%	100%	100%	100%

Correlation between depth and street condition has shown that, within the city centre, the former may predict the latter. Streets two steps in depth are always paved. Streets from three to five steps in depth are either paved or landfilled. And streets from seven to eight steps in depth may be of any type. In other words, most paved streets are a few steps distant from the two most locally integrated streets, most landfilled streets have intermediate depths, while raised wooden walkways and paths always are six steps of depth or more (Table 6.26). This supports the hypothesis of a gradual process of improvement dependent on street hierarchy (and potential to centrality) in the system, and indicates a correspondence between spatial and socio-economic differentiation, expressed by the distinct amounts of investment noticeable over different depths.

Table 6.26. **Street condition against depth**. City centre								
	2	3	4	5	6	7	8	Total
Paved street	100%	75.0%	57.1%	37.0%	3.7%	-	-	38.4%
Landfilled street	-	25.0%	39.3%	56.5%	70.0%	66.7%	85.7%	50.0%
Path	-	-	-	-	14.8%	11.1%	14.3%	4.4%
Raised walkway	-	-	-	2.2%	11.1%	16.7%	-	5.1%
River bank	-	-	-	4.3%	-	5.6%	-	1.9%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Within Paracuri basin the correlation is less clear (Table 6.27). It is distorted because the Arthur Bernardes Road is paved and it (the road) is constituted by a few axial lines which are drawn away from the locally most integrated street. Paths and raised wooden walkways are more frequent than in the city centre (although in the expansion area the site needs less landfill); nevertheless, they are fewer steps in depth and have different widths from their city centre counterparts. The existing grids are still too loose to generate local differentiation between streets through centrality mechanisms.

Table 6.27. **Street condition against depth**. Expansion area

	2	3	4	5	6	7	8	Total
Paved street	-	62.5%	8.3%	-	8.7%	-	-	11.3%
Landfilled street	100.0%	12.5%	75.0%	58.3%	69.6%	-	100%	60.6%
Path	-	25.0%	8.3%	29.2%	17.4%	-	-	19.7%
Raised walkway	-	-	8.3%	12.5%	4.3%	-	-	7.0%
River bank	-	-	-	-	-	100%	-	1.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Within the city centre, the narrowest streets are never paved (Fig. 6.18). Paths and raised wooden walkways have a maximum of 9 and 6 meters width respectively. Most streets within Tucunduba basin are either landfilled or paved. In Paracuri basin case study areas, pavement is restricted to the most important roads. There is no difference in the range of width of landfilled streets, paths and raised wooden walkways; any of these may reach 20 meters, since the wooden walkway is built in the middle of the space reserved for the street; the house front doors are connected to the walkway through narrower wooden walkways (Fig. 6.19). By examining aerial views and maps of Santa Casa, it is possible to observe that similar factors have been operative there, resulting in the present street widening. These street widenings occur in previously permanently flooded areas, where occupation gradually intensified along the street lengths over time.

Fig 6.18. Streets in Tucunduba basin. Left, raised wooden walkways (*estivas*) above water. Right: Landfilled alley of access to middle block. (photos: Marcos Bitterncourt).

Fig. 6.19. Streets in Paracuri basin. Left, an average street in Arthur Bernardes case study area. Right, an average street in Paracuri case study area. (left photo: Marcos Bittencourt).

Observation of street type against street width in the city centre (Table 6.28) showed that most of the widest streets are the upgraded ones, followed by implementation streets, while the narrowest streets are the closed ones. This indicates a correspondence of street width with the street hierarchy described through street type and depth, reinforcing the existence of a structure in that space. This presents diverse alternatives to settlers regarding levels of accessibility and amount of investment required to access housing. In the expansion area, most street types have widths concentrated in intermediate levels, indicating the dominance of streets over grids in that area, and a weaker potential for centrality and a movement economy (Table 6.29).

Table 6.28. **Street type against street width**. City centre

	Implementation	Union	Closed	Local implementation	Enhanced union	Up grade	Total
Up to 3 m	-	11.1%	18.2%	7.5%	-	-	6.3%
+ 3 - 6 m	-	**25.0%**	**81.8%**	18.9%	**26.3%**	-	20.8%
+ 6 - 9 m	14.8%	**25.0%**	-	**37.7%**	**26.3%**	-	23.9%
+ 9 - 12 m	25.9%	16.7%	-	24.5%	21.1%	-	18.9%
+ 12 – 15 m	14.8%	11.1%	-	7.5%	21.1%	7.7%	10.7%
+ 15 – 18 m	-	11.1%	-	1.9%	-	15.4%	4.4%
+ 18 – 21 m	**40.7%**	-	-	-	5.3%	7.7%	8.2%
+ 21 m	3.7%	-	-	1.9%	-	**69.2%**	6.9%
Total	100%	100%	100%	100%	100%	100%	100%

Table 6. 29. **Street type against street width**. Expansion area

	Primary	Implementation	Union	Closed	Local implementation	Enhanced union	Total
Up to 3 m	-	4.0%	-	-	-	-	1.4%
+ 3 – 6 m	-	12.0%	9.1%	**100%**	-	-	6.8%
+ 6 – 9 m	-	4.0%	18.2%	-	-	-	4.1%
+ 9 – 12 m	-	24.0%	**36.4%**	-	14.3%	-	17.8%
+ 12 – 15 m	-	**32.0%**	27.3%	-	**76.2%**	**80.0%**	**47.9%**
+ 15 – 18 m	-	4.0%	-	-	-	-	1.4%
+ 18 – 21 m	-	20.0%	-	-	9.5%	20.0%	12.4%
+ 21 m	**100%**	-	9.1%	-	-	-	8.2%
Total	100%	100%	100%	100%	100%	100%	100%

6.4.3. Urban form, density and health

The remaining street widenings in Tucunduba basin have made streets more useful resources in environmental and social terms. Middle blocks have provided a place for density increase, with the replacement of natural vegetation or orchards by rows of rooms to rent or by new buildings and, sometimes, plots. This has resulted in an absence of green spaces and in a very homogeneous occupation (same building height, lack of openings into the built form, similar typologies of buildings and streets). These morphological characteristics have proved to be disadvantageous to inhabitants of Tucunduba basin in the local climatic context, causing higher temperatures than in other parts of the city.

Belem has a latitude of 1º 28' 3'' S, and an equatorial humid climate characterised by high temperatures, weak winds, and high levels of humidity and precipitation (1500 to 3000 mm of rain per year) (Cabral, 1995). Cabral's (1995) study of the relationship between climate and urban morphology in Belem found that temperatures were always higher within the Bay and on the Guama River banks where Tucunduba basin is located, than in inner areas of the city. This was attributed to the banks' location in relation to major wind directions (these areas are located southwards, behind the concentration of high rise buildings, while the major wind directions are east and northeast) and to current morphological characteristics within these areas: high construction density, excessive uniformity of building height and lack of enough openings into the built form (p. 78).

The context of inhabitants' poverty has determined access as their priority, and their choice to settle on sites with initially poor physical conditions, to be gradually occupied and improved. However, it has also meant unhealthy standards for long term occupation, caused by a combination of minimum spaces, infrastructure solutions adapted from the countryside, where sparse occupation encourages certain habits (e.g.: water consumption and waste disposal from and to the same water stream), and increasing densities.

The expansion area case studies showed more positive prospects, since they are not located behind any barrier to the wind, have a smaller proportion of built soil coverage, and are surrounded by vegetation. However, comparisons between all case study area raw densities have shown that Arthur Bernardes settlements have levels of densities similar to those found in Tucunduba basin (Table 6.30). This raises considerations about the relation of time to density. The influence of time might be more decisive in global terms, with respect to the evolution of the land market in the city

and the action of agents (investigated in Chapter 8), than only as a dimension of density increase; also, variables other than timescale may be relevant to density.

Fig 6.20. Occupation conditions in Tucunduba basin. Top left: street widening in Tucunduba case study area. Top right: regular typologies in Tucunduba basin. Bottom left: conditions of occupation along the river bank in Tucunduba case study area. Bottom right: canal full of plastic bottles in Santa Casa case study area. (Photos: Marcos Bittencourt, except bottom right).

Fig 6.21. Occupation conditions in Paracuri basin. Left: conditions of occupation in Arthur Bernardes case study; notice the vegetation in the background. Right: an empty plot (usually 7m or 8m wide per 14m long), and the dominant building typology. (Photos: Marcos Bittencourt).

Table 6.30 – Summary of case study areas' general characteristics					
	City centre			Expansion area	
	Santa Casa	Santa Cruz	Tucunduba	Paracuri	Arthur Bernardes
Density dw/ha	58	78	73	28	75.5 and 56
Pop. density	290 pp/ha	390 pp/ha	365 pp/ha	140 pp/ha	377.5 pp/ha and 280 pp/ha
Tenure	Regularised	Not regularised	Not regularised	Regularised	Not regularised
Integration	Shallow	Intermediate	Deep	Deep	Upper intermediate
Drainage	Complete *	Streets drained, blocks flooded	Partially flooded area	Complete*	Partially flooded area

(*) Drainage works to avoid permanent floods were carried out, often by the building of canals. However, many streets in the area have still to receive drainage pipes, a prior condition to paving.

The lowest levels of density in each basin seem to be associated with tenure regularisation, and to complete drainage works, and therefore to a more precise definition of block and plot limits; access seems to have a secondary influence on density levels, and is divided into the conventional (through streets) and the alternative (through a river). Among unregularised areas, accessibility may be a factor increasing density, especially because absence of tenured ownership allows further invasions, and better accessibility makes the area attractive to new invaders (interviews: fieldwork, 2000). However, density levels in Arthur Bernardes were determined before occupation, according to the understanding of the informal developer of what constituted a fair plot size to settlers, certainly influenced by the city land market.

Occupation within Tucunduba's case study areas is characterised by middle block occupation; Santa Casa's blocks are small, with buildings expanded towards the middle block, and divided into well-defined plots. Santa Cruz has bigger blocks, often flooded and occupied by many rows of buildings, as a result of successive invasions; in such conditions plots do not have clear boundaries and access to inner buildings is made through tiny alleys. In Tucunduba case study areas, middle block occupation is made through inner plots. In the expansion area, middle block occupation does not occur; plots and blocks are clearly defined within Paracuri. In Arthur Bernardes settlements, streets and plots were previously defined, but blocks are still being reshaped towards the settlements' edges.

Building typologies are defined by material, i.e. wood or bricks and mortar, and height, one or two storeys high. Houses built with bricks and mortar are more common where there was up-grade, and are often of one storey. In intermediate cases and flooded areas wood is much more common (because it is the lightest material available), and two storey houses are more frequently made of

wood and may occur in any street. Wood is meant to offer better environmental performance than bricks and mortar when plots are narrow (favouring better ventilation and less insulation), as is always the case in informal areas (facade average is five meters), but inhabitants judge that bricks are less costly in the long run because they do not need as much maintenance as wood does (interviews: fieldwork, 2000). Wooden two storey houses are more permanent and built in more stable conditions; they do not occur, for instance, in Santa Cruz middle blocks (Fig. 6.22).

Fig 6.22. Building typologies in Tucunduba basin. Left: replacement of wooden houses by houses built with bricks and mortar in the recently upgraded avenue in Santa Cruz. Right: Wooden two storey houses in a street gradually landfilled with works cast-offs and rubbish.

The present density levels are far below the optimal one of 600 pp/ha, which provides the maximum return on investment in infrastructure provision in middle-sized cities (Mascaró, 1987:158-161). Their increase would not be a problem in many other contexts (Mascaró, 1987; Aciloy & Davidson, 1998; Hall, 1999), but given the context of poverty, the equatorial climate and the morphological and infrastructure conditions already described, higher densities serve as a negative indicator of physical infrastructure provision. Nevertheless, higher densities may be taken as a secondary indicator (after accessibility potential) of positive social infrastructure, in terms of offering more choices of services and commercial activities, as observed in the next section of this chapter. Such divergence indicates the importance of urban form as a means of environmental balance and sustainability in poor equatorial contexts.

The precariousness of built form also prompts water-born diseases. Local research on water quality has demonstrated that cases of water contamination in taps located in the Tucunduba basin, near this thesis' case study areas, were clearly associated with leakage of water distribution pipes and insufficient chlorine (Moreira, 2001). Those located close to Santa Cruz are critical points of contamination over the whole year (high levels of precipitation increase the potential for contamination, above all in flooded areas). As a result of this, the most frequent diseases in the city

zone wherein Tucunduba basin is located are fever, colds, allergies, asthma, dengue, worm infections and leptospirosis (Chaves & Baia, 2000). Table 6.31 shows official numbers of diseases occurring in the zone (DAGUA Administrative Disctrict) over a period of one year.

Table 6.31. **Occurrence of poverty-related diseases in DAGUA** (part of Tucunduba basin)

Disease	Gender		Total
	Male	Female	
Hepatitis A and B	58	38	96
Leptospirosis	43	13	56
Diarrhoea *	458	383	841
Squistosomiasis	8	6	14

* 25% < 1 year old, 54% 1 to 4 years old

Source: Health Municipal Secretary (SESMA); quoted in Chaves & Baia (2000:9)

Nunan & Satterthwaite (1999) argue that many infectious and parasitic disease vectors thrive when water, sanitation and drainage provision, garbage collection and health care fail or break down. In these cases, cities become 'among the most health-threatening of all human environments as disease-causing agents and disease vectors multiply, as the large concentration of people living in close proximity to each other increases the risk of disease transmission, and as health care systems become unable to respond rapidly and effectively' (ibid. p. 6) (see Fig. 6.24).

Fig 6.23. Sanitary conditions in Tucunduba basin. Left: stagnant water below houses. Right: landfilled alley in the middle of a flooded block.

Even though these diseases are not always life-threatening (see Table 6.32), they are health-threatening to people either living or working in environments not served by basic infrastructure and are likely to be a major cause of urban poverty. The literature about the relationship between

unhealthy environments and low income and about the effect of exposure to environmental diseases on infected people's economic conditions is scarce, but it is obvious that a higher income allows access to less risky housing conditions.

Table 6.32. **Number of deaths within Belém due to diseases commonly associated with poverty**

	1998	1999	2000
Diarrhoea	92	51	67
Malnutrition	54	58	62
Hepatitis	24	32	25
Lepitospirosis	28	26	21
Dengue	3	-	4
Cholera	-	3	-
Total of deaths	3,067	3,251	3,486

Source: Data Basis of Sistema Unico de Saude (DATASUS) Brazilian Health Ministry. Data consolidated by the Planning and Governance Municipal Secretariat (SEGEP).

It is evident that the brown agenda deserves attention in these informal settlements. Floodplain occupation cannot walk backwards, and despite the environmental degradation this occupation implies, actions explained in the next section makes it possible to say that these populations' threats to the environment are the consequence of poverty, rather than a waste of finite resources. The inhabitants are very creative in their use of space and sensitive to recycling practices; they also undergo struggles in their personal and community lives to improve maintenance of public spaces, despite the precarious infrastructure.

6.4.4. Sub–conclusion to 'provision'

This section was dedicated to the assessment of the contribution of provision to the potential offered by entitlements. The space of case study areas is a vernacular space, produced according to its inhabitants' economic constraints, and required an appropriate method to describe and analyse its patterns of production. Site configuration has conditioned occupation from the existing grid towards a river (Tucunduba River within the city centre and Paracuri River in the expansion area), which are used as routes of access. More consolidated settlements present at least two important edges in their process of occupation. In the expansion area there is only one important edge in each settlement. The application of Cannigia's & Maffei's (1995) typology resulted in a classification of streets according to their process of generation and evolution, and the identification of peculiar patterns of street layout in each basin.

The street layout in Tucunduba basin, already identified as grid-oriented by syntactic measurements, showed itself subdivided in different scales according to the arrangements of the street system created through subdivision of the fat original blocks simultaneously with density increase. In Paracuri, the route-oriented street layout offered a diverse procedure for expansion,

extending implementation streets over the unoccupied territory, and creating narrower blocks than the original ones in the city centre.

Cross-tabulation between type of street and depth clarified the hierarchy of grids and showed that the process of centrality is repeated on decreasing scales in Tucunduba basin. Even among the most segregated streets, there are arrangements to interconnect grids (embedding new grids) which follow the same principle of centrality presented by the whole system. These are too segregated to be identified only through the maps of depth presented in the previous section. A similar process occurs in Paracuri basin, despite the differences of scale and intensity.

Cross-tabulation between type of street and street conditions showed that the generation of the grid hierarchy follows a gradual process of street improvement (drainage, landfill and pavement occur first in the streets with higher potential for accessibility). Cross-tabulation between depth and street conditions showed that the first predicts the latter in the city centre. There is a correspondence between spatial and socio-economic differentiation expressed by the distinct amounts of investment noticeable over different depths. In Paracuri basin the grids are still too loose to generate a strong differentiation of streets in the case study areas.

Cross-tabulation between street type and street width supported the grid hierarchy in Tucunduba basin and the dominance of streets in Paracuri. Street condition is fundamental to the gradation between private (the internal space) and public space (the space shared by inhabitants and outsiders) in the city centre, while in the extension area, wider streets allow plot and building features to contribute to open space differentiation. This sequence of findings expresses how the condition of scarcity determines the land market in Belém. Globally, location contributes to provision through the status it gives to each area within the city land market. Within a third world city this is associated with city growth; always when a new settlement is created in the periphery, the value of existing land increases towards the city centre. Central areas become more sought after and scarce, most valuable and prone to receive more investment.

Timescale defines street hierarchy and change in street status, through extension of occupation and infrastructure provision. Streets that extend settlements usually have worst infrastructure conditions. Location and timescale indicate the tendency of settlement aggregation. The oldest settlements, located in the city centre, form bigger areas over time, which in turn originate districts. New settlements lack secondary links.

Increase in extension of building coverage and increase of built density are negatively associated with the city's climatic conditions, and with infrastructure solutions affordable by inhabitants,

increasing health problems (and disadvantaged work performance) and the perpetuation of poverty among inhabitants. Nevertheless, higher densities are positively associated with social infrastructure provision when present in extensive areas.

Moreover approximation between the present levels of density in Tucunduba and Paracuri basin (Santa Cruz and Arthur Bernardes) shows that the influence of time is decisive in global terms. It is incorporated through the evolution of the land market in the city as a whole, and changes in the action of agents (e.g.: the settlements in the expansion area are already privileged locations compared to others located on the outskirts of the other municipalities that constitute the Belém Metropolitan Region).

Further comparisons showed that tenure regularisation helps to keep density lower, due to clear definition of plot and block limits, preventing further invasions arising from the attractiveness of accessibility. Up to certain levels of density, the space analysed showed itself extremely well structured, but unhealthy, due to lack of infrastructure.

6.5. 'Ligatures'

6.5.1. The case study areas' public space

The case study areas' public space is defined by a continuous system of streets and in some areas by permeable (due to lack of fences between plots) blocks. This creates many choices of route for pedestrians, which vary according to the degree of the pedestrian's intimacy with the area. These spaces present progressive enhancement of inhabitants' control of open spaces, ranging from shared control by inhabitants and outsiders in the main avenues, towards a strong control by inhabitants in the most segregated streets. From what was explained in the previous sections it is possible to say that physical conditions and street depth define the routes for vehicles: the most integrated streets are usually better paved and larger than the others, providing better choices for vehicles.

Settlements in the city centre have grown in density through middle block occupation, and in the expansion area through addition of new street segments that form new blocks afterwards. The space is robust in both areas (city centre and expansion area). Individual houses, rows of houses, and even a block can be replaced, as has been the case when schools were built. The street layout absorbs local changes (either of land uses or typologies) easily and is differentiated by them. In more segregated areas, houses are built following similar typological solutions and using the same materials, and in more integrated areas typologies and building materials are more diverse.

The facades of the buildings, almost entirely houses, whose front doors open straight to the street, define the public space. This is a characteristic present in streets and in the case study areas as a whole, with a few exceptions, as in the case of schools and cemetery walls. Lateral facades are usually attached in the city centre, with occurrences of narrow lateral setbacks (of less than one metre) that give access to other houses located at the back of those which face streets. Hence blocks are formed as islands with several layers of occupation from the street towards the middle. This has allowed an increase in density, while keeping the one or two storey typology of houses, and created semi-private spaces between houses inside the blocks. The quality of this inner space varies according to the site's physical conditions. For instance, the middle block occupation in Control 1, in a block facing a lively avenue, has inner paved streets of six metres, whereas in Santa Cruz the middle block is permanently waterlogged, and access is defined by raised wooden walkways, which start behind the lateral setbacks of houses that are facing the street (Fig 6.24).

Fig 6.24. Examples of middle block occupation in Tucunduba basin. Left: landfilled alley. Right: transitional alley (Photos: Marcos Bittencourt).

In the expansion area, building arrangements are more heterogeneous than in the city centre. Buildings are attached laterally when located on important local roads. To the extent that the streets become more segregated, houses are detached from others and might have some sort of veranda or deck connecting to the public path or raised wooden walkway. There is no middle block occupation, since blocks are much narrower than in the city centre (as explained in the section on provision). Site physical conditions are generally much better than in the city centre, being without originally extensively flooded areas (areas vulnerable to floods are usually concentrated on the edges towards the riverbanks). Often blocks are not yet completely formed on the edges of these settlements, although definition of street public space is clearly provided by fences or facades. The occurrence of a frontal setback is common in the expansion area; however, the plot itself is usually not marked out by fences where facing the street, as it is in its other limits. This creates spaces in front of the houses, normally used for children's play and adults' chats.

The existence of a second use (other than housing) in a building is common. Small butchers, shops, garages, occupy the house front room in the city centre in more locally integrated streets. These might provide a bench and a roof for consumer comfort, which are also used for chats. Most grocery shops are family shops located on corners, and supermarkets do not exist (Fig. 6.25). The streets do not have sidewalks, and space is essentially instrumental; it allows social contact with neighbours, access to shops and workplaces, it provides space for leisure, and sometimes is taken as a house extension, despite the constraints of physical conditions.

Fig 6.25. Street junction in Paracuri case study area; on the left side there is a bar, and on the right is a grocery shop.

To the extent that streets received landfill, houses were raised to follow the new levels, independent of the plots' situation. When the plot is still waterlogged, rubbish is usually accumulated below the house, encouraging pests and diseases. When inhabitants are fortunate enough to landfill the plot, a new house is often built, either of bricks or of better wood. In general, those areas are seen by the rest of the city as edges. They seldom show flows of outsider pedestrians or vehicles, especially in their inner streets which are more precarious and strongly controlled by inhabitants. However, all of them are somehow connected to lively areas (as explained in the section on entitlements). The Santa Casa case study area is very close to a powerful local commercial area. Tucunduba is close to the most used access route to the university. Santa Cruz's new upgrade avenue represents an alternative connection between the city centre and the university and other institutional areas. Paracuri is more insulated, but with its main access starting in a commercial area, and Arthur Bernardes has a road as its main street.

6.5.2. The users of public space

Overall, these spaces have a strong identity, and seem to fit a specific lifestyle, that of those who strongly rely on space to carry out their everyday activities through social solidarities (Hanson, 2000:115). The solidarities are differentiated by gender, social class, age, etc. and the former are able to imprint on space the equality or inequality of existing relationships (Hillier and Hanson, 1984:240). In this sense, locally controlled space should provide best conditions for child

surveillance, for the demands of elders, disabled and sick for assistance, and for mitigating unemployed vulnerability.

However, from what was observed in the case study areas, the excessive segregation in relation to the whole city, combined with overcrowding, exaggerates social problems that lead to insecurity. Children and teenagers take part in gangs; the unemployed join in criminal activities and social and health assistance become even scarcer. Such a situation inspires two broad behaviours among the other inhabitants, dividing them into two types – conformers and aspirers (Hanson, 2000:116).

The conformers are usually manual workers, who practice and depend on street-oriented local solidarity, and have a strong spatial social network. They manage to benefit from space despite existing constraints, for instance by allowing children to use streets as playing space, even though these streets are a route for buses and have occasional flows of vehicles. Conformers might have either a positive or a negative attitude, behaving to the benefit of the community or against it. They have a positive attitude when they help by watching the children who are playing outside, or a negative one when they throw rubbish into the street or into the canals instead of placing it for collection at due times.

The aspirers are the shopkeepers and better-off inhabitants who use distance and avoidance to control unwanted interaction. They have a more formal and home-centered lifestyle, limiting their relationship with neighbours to greetings, but usually co-operative in case of need. The family who owns a shop in Arthur Bernardes road and shares its well with another 30 families in the settlement is an example. These inhabitants are looking forward to settlement upgrade and consolidation, and usually have houses with better standards than the average. They usually are either children of the original inhabitants, who judge that the settlement should have improved more over time (common in Santa Casa, where these aspirers are now in their 40s and 50s); or are newcomers, who wanted to benefit from low land prices or from potential for services and commercial activities.

6.5.3. The usage of public space

Field observation carried out on a selected route within case study areas showed that the actions that take place in streets are performed by all ages and genders (Fig. 6.26). These actions are either impersonal, usually involving service and commercial relations, or personal, involving people with different degrees of intimacy. The range of activities observed can be described in four general categories – work (workers using muscular strength, counter shop workers, manufacturers), entertainment (people resting, drinking, partying, chatting, attending services), consumption (people buying, waiting, queuing, walking) and care for something (people watching, cleaning, fixing, recycling, looking after, etc.).

FIG. 6.26: MAP OF FIELD OBSERVATION ROUTES
(Source: CELPA, 1998; CODEM, 1998)

These actions' occurrence was taken as a differential of physical and social consolidation level between case study areas. They provide evidence about the intensity of commercial and related activities practised within the settlements, about the level of solidarity among adults related to child surveillance, about the practice of street watching, occurrence of house improvement, and the most common types of street users in each settlement. These were used by Hillier et all (2000) as indicators of consolidation in Santiago's informal settlements.

6.5.3.1. Tucunduba basin

The observation route in Santa Casa started in the road, part of Control 1, where the schools (one on each corner) are located and entered the settlement towards the other portion of the Control 1 area, where the official settlement is. The main inner streets were chosen by the frequency with which they appeared in mental maps and in comments by inhabitants about very used spaces. This allowed the definition of a richer route, covering different types of street, from the edges (or points of contact with the formal city), passing to important inner streets and more local streets.

Carts are the most frequently seen means of transport to deliver and sell goods in the area, followed by bicycles. Inhabitants extensively explore a street's centrality potential, houses usually are used for other activities besides housing. Shops and garages are mixed with residential use; moreover stalls and kiosks allow inhabitants to take advantage of a good location at specific times and during certain weekdays. Street vendors concentrate around the schools to sell candies to children, and stalls and small shops for food concentrate along the routes to the market and open market. Public services are provided and access for vehicles into the streets is widely possible (Fig. 6.27).

Leisure choice is very restricted in spatial terms (limited space limits activity options). However, the community manages to use football fields belonging to schools, and the space of streets located inside the area works as a semi-private space rather than as a public space, for children and other groups highly dependent on space. Adults drink alcohol and soft drinks in bars, stalls and houses; this seems to be the most common option for spending leisure. Male adults are seen drinking and playing during conventional working time, indicating the existence of a different system of livelihood (nocturnal, periodic, not formal jobs). The active social entities in the area are linked to the Catholic church and give special attention to the population of children suffering from malnutrition.

Only in the external avenues (part of Control 1) do local and external users share the same public space, creating a denser virtual community; inner streets favour local control and appear less inviting to outsiders. Although contact between inhabitants within inner areas is not as intimate as it

is in other case study areas, the density of building allowed houses to be completely built, with walls defining plots and railings protecting entrances. Old inhabitants are not interested in upgrades, such as to meet setback demands to enlarge street width (inhabitants' comments to interviewers: 2000) that would alter their houses.

Fig 6.27. Activities in Santa Casa.Top left: signs of building works (hill of sand on the left). Top right, man pushing a chart, railing protecting shop. Bottom left: bicycle workshop. Bottom right: children playing on the canal bank opposite a shop.

Box 6.1. Activities in Santa Casa

Consumer time is Saturday morning, traditionally the time for shopping. The open market located in the road where the route starts draws dozens of people; all the shops in the road are opened, and street vendors locate themselves over surrounding streets to benefit from the movement. Street vendors' strategies vary; they stand at stalls, push carts or carry trays to sell their products, usually food. It is also possible to spot housebuilding works in progress.

Sunday is the time to have fun; commercial activities are less intense in the morning and closed in the afternoon, and only stalls of snacks open at this time. Many adults party and drink alcohol in bars, a few adults care for their environments, cleaning the public space and improving their houses, teenagers chat and play football, families attend religious service in the church.

Weekdays are mixed days, in which everything happens. Street vendors concentrate in the schools' vincinity, selling candies, lollies and snacks to the crowd of children who come to school. In the early morning more than 20 people come at once from the open market. Children wearing school uniforms play football in front of the school, many children improvise games in front of their houses. Workers work at housebuilding, a few adults drink and listen to music in bars. Others work with carts delivering goods, others help their elders and handicapped, and when the weekend approaches again, on Friday evening, it is easier to spot prostitutes waiting for clients in bars.

The observation route in Santa Cruz was around a ring, passing through an upgraded street, segments of lively streets and a more residential one. The very segregated streets were avoided, because inhabitants had shown signs of hostility to strangers during the previous stages of the research. Santa Cruz's present stage of consolidation has been more open to change. The street where the local open market happens is a short street, one step less deep than the recently upgraded avenue which connects denser streets. The open market happens on Saturday mornings; other vending activities exploit regional food, and snacks are sold to people who are playing or watching the street. Inhabitants' relationship with space is changeable over the day. Even the larger streets are used as semi-private spaces by inhabitants, despite the increase of traffic, propelled by upgrade actions. There is tap water, but people wash clothes in front of their houses to exploit distribution water pipes; children's activities conflict with bus traffic, and during the evening children and teenagers pop all over the new avenue to play.

Groups of adults are very diverse; there are inhabitants who undertake street maintenance and try to keep the public space clean, those who work at home, those who attend church services and those who drink and play during day-time. The communitarian centre promotes activities to help the community in many ways, offering nursery care, raising money to help sick people, or people who need to improve a deteriorated house but cannot afford to do so. Children are always looking for space to play and are often watched by adults. Houses are not at a stable stage; plots are still receiving landfill and houses are still being raised to prevent water entering. Physical changes in Santa Cruz are more acceptable than in Santa Casa, and often desired by inhabitants. Many public services are already provided - water, electricity, rubbish collection and transport - but sewer and plot drainage has not been sorted out. People used to the old patterns (conformers) still throw unwanted objects into the canal, instead of placing them to be collected. Carts and wheelbarrows are fickle means of transport in several situations (Fig 6.28).

Fig 6.28. Activities in Santa Cruz. Top left: people coming from the open market. Top right: games on the street. Middle left: football match on the street. Middle right: an open kitchen. Bottom left: the new avenue, see kiosk and people seated on the railing at the back. Bottom right: the communitarian centre.

Box 6.2. Activities in Santa Cruz.

Saturday morning is the time to wait for customers in the small street open market. Meanwhile people chat while working or serving a customer. In the other streets some people go to church services, others enjoy Saturday to do domestic tasks or to carry on with housebuilding work. The evening is a leisure time; games take place in the streets, and vendors prepare snacks, barbecues, chips, to serve those who play and those who watch the movement in the street.

Sunday is not very different from Saturday; the same activities (vending, chats, parties, games, hand-washing in front of the house, etc.) take place along the route. Weekdays are calm, a few people wait for the bus, children go to school, street vendors sell fruits, inhabitants do street maintenance and work at

home, and housewives carry out their domestic tasks. In the evening, especially Friday, the upgrade street is full of people, teenagers sit on the canal's railings, people organise barbecues in front of their houses, gentlemen play cards, children play football, volleyball, hopscotch, etc., organised in teams. Vendors enjoy the movement.

The observation route in Tucunduba began from the main road towards the river (more precisely, towards the bridge that connects the area to the other side of the river), then turning back to the starting point. The internal ring was formed by the routes most cited by inhabitants, and it also provided the experience of different types of space. Inhabitants also take advantage of street centrality potential in this area; the well-paved road is the place of the open market, and is also shallower (in syntactical terms) than the other streets (Fig 6.17). Street vending is orientated to sale of snacks, candies, and regional food; however, in the poorest areas, commercial activities happen, on a very small scale, through the sale of charcoal, ice and cigarettes, orientated to those who do not have fridges and stoves (fieldwork, 2000) (Fig.6.29).

Differences between inhabitants are more noticeable, since alcohol abuse is more evident and religious censorship is more rigorous (fieldwork, 2000). The lack of public space is a problem, sorted out through the use of improvised terraces and the street space, which also works as a semi-private space rather than as public or semi-public. The precarious water provision is apparent from the collection of water from distribution pipes through leaks, which also are associated with many water-related diseases. Because of the area's many constraints, it is often an object of research carried out by the academic community of the university, inclusive of the hospitals; and the municipality has an upgrade project in progress in the area (Fig. 6.30).

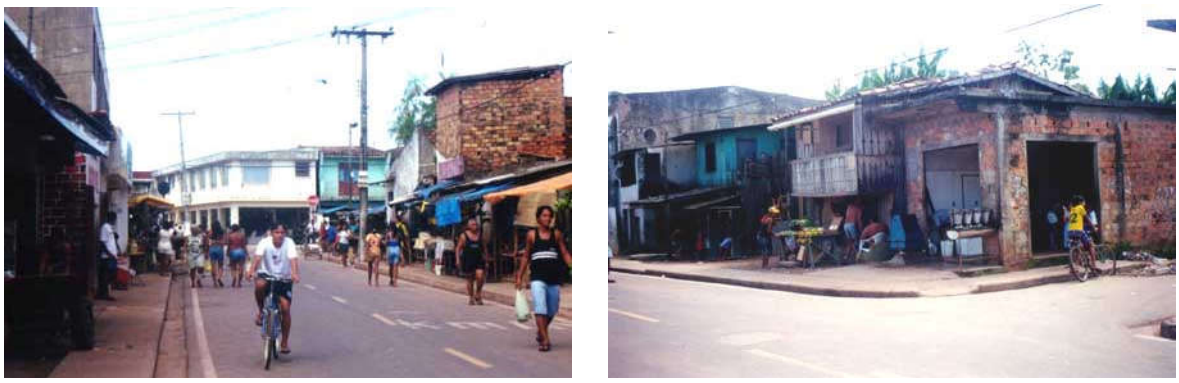


Fig. 6.29. Activities in Tucunduba case study area. Left: open market in the main street. Right: butcher and shops in the main street.

Fig. 6.30. Activities in Tucunduba case study area. Top left: improvised table tennis. Top right: children playing on the street. Bottom: life on the *estivas* (Photos: Marcos Bittencourt). The sequence of photos shows the transition from the road towards the river.

Box 6.3. Activities in Tucunduba

Days do not differ very much in Tucunduba. On the main road, stalls selling herbs, cigarettes, regional food, candies, etc. are open every day of the week in the mornings. Children are usually flying kites or playing football in the streets, especially in the afternoons, watched by adults who are playing cards or chatting around. Students walk on their way to school. Butchers and shopkeepers chat while they wait for customers. And people occasionally carry water from the street pipes located bellow the raised wooden walkway.

The weekend is differentiated by people carrying bibles on their way to Protestant churches in the morning, and lively afternoons, when chairs are placed in front of the houses and on the uncovered slabs to watch the street movement. Bars are crowded, alcohol is also consumed in some houses. Streets offer food (sold from stalls) and entertainment to inhabitants.

6.5.3.2. Paracuri basin

Field observation conditions are more favorable in Paracuri basin than in Tucunduba, because there is, apparently, less social tension in Paracuri, and the Arthur Bernardes route was more manageable. The route in Paracuri started at the road, taken as part of Control 2, followed the main access to Paracuri settlement up to the school, and from there went towards the football field

facing the official settlement, part of Control 2. From there it returned to the beginning, forming a ring along more local streets. In this way the route incorporated the inhabitants' main landmarks. In Arthur Bernardes settlements (named by inhabitants Guará and Central Park), the road is the main street, and from there it was possible to enter and observe the crossing streets.

Paracuri has a particular activity, the pottery. Inhabitants extract the clay from the river bed, transport pottery and raw material on the river, and sell them in workshops located along the road which gives access to the settlement and sets the boundary with the historic village of Icoaraci. However, workshops no longer provide enough work for all local workers; because of that, bars, small shops and street vending also proliferate. Stalls and wheelbarrows sell fruits and regional food at lively points and routes.

There is more space available and this can be seen in how children play outdoors, always between the houses and the street, in a sort of setback, and in the quantity of plots with wells. There is no piped water in the area, but most households have wells. Those who do not have one use water from neighbours' wells located near them. The football field helps male leisure activity and the school offers sport and cultural activities to all students. The street space is also used for other sports such as volleyball. There are other important local institutions, such as a club and the Protestant churches spread over the area (Fig.6.31).

Fig 6.31. Activities in Paracuri case study area. Top left: football field. Top right: deal of bricks at the bridge. Bottom left: space for gathering in front of a house. Bottom right: children playing on the river's bank.

The spatial hierarchy range is well established in Paracuri; private, semi-private, semi-public and public space are more identifiable there than in the city centre case study areas. Differently from the other case study areas, complaints about violence are decreasing in Paracuri, while increasing within the denser central areas. Arthur Bernardes has not changed, although it has never been a safe place.

Box 6. 4. Activities in Paracuri

Sales of pottery are still seen on the way towards Paracuri on a Saturday morning. Adults perform their domestic tasks and chat while watching the street. Elders sell herbs, seated in their house verandas, but children are having fun playing sports in the street, in the football field and in the big shack close to the latter. Cyclists are readily noticeable, children also help to carry water from wells, and by the end of the day neighbours have lively chat in front of their houses while children play.

On Sunday morning, people buy vegetables from a stall; there are still people in a bar drinking and drunk, and there are queues to take water from wells. Teenagers go to church holding their bibles, and people carry on work and domestic activities.

On weekdays men trade clay close to the bridge. Children go to school, but do not always have classes. Women work in their houses. Men are seen chatting in the streets and drinking in bars. Children are playing around the houses. Evangelists try to convert people in the streets.

In Arthur Bernardes settlements, the space of inner streets works as an extension of the private space. People still fear eviction, have a more marginal condition, and have more difficulties related to infrastructure than elsewhere, since streets are not properly defined towards the edges, and there is no piped water. A few households have wells, which are shared with neighbours; raised wooden walkways form the basis of streets further from the road. Industrial activity opposite the settlements helps to diversify commercial activities and services, creating a visible difference between land uses and typologies facing the road and those internal to the settlements.

The road is where wealthier shop-keepers and self-employed workers are established, to benefit from location, while poverty increases along side streets. Building work is intense, as everything has to be built and human force is the main motor of change. This was the place of strongest interdependence between neighbours, expressed through the highest degree of intimacy observed in case study areas. It was also where handicapped people were seen working in stalls (Fig 6.32).

Fig 6.32. Activities in Arthur Bernardes. Top left: inhabitants watching the street, chatting and buying in a junction between the main road and another street. Top right: the road. Bottom left: inhabitants maintaining ditches. Bottom right: hill of sand obstructing the street (building work).

Box 6. 5. Activities in Arthur Bernardes settlements

This weekend one street is obstructed with sand and another with a hill of clay in Central Park (one of Arthur Bernardes case study area settlements), offering children a new attraction. They climb on the hills while watched by adults.

Children also work, trimming grass. People queue at the well and carry water as always, but those who can afford it can buy it from the street vendor. Men still drunken from the previous night are still in the bar on Sunday morning. New parents walk in the streets with their babies, to take sunbaths in the morning.

In Guará the bars and snack bars are full; people go there to watch football matches on television, to play cards, eat and drink. Workers work on building sites and in workshops; others go to church, others carry water and wood in wheelbarrows. On Sunday people sleep in hammocks on their verandas and children bathe in the river. In the evening they a have privileged view of the sunset.

Weekdays are a time of building work for men in Central Park, and work in the domestic routine with house tasks and children for women. Children go to school and play on their house verandas, on the streets, and on the football field, but also work trimming the grass. Carts sell charcoal; people queue to buy açaí (a palm tree juice), and are always carrying water.

In Guará men are also involved in building; the craftsmen work in the workshops, others drink in a bar. Workers from the companies opposite to the settlement also come to the bars. Mothers look after their babies and children; children go to school, play in the street, help to carry water, and also sell water. Wood, donated by a politician, is delivered to the settlement. It will be used to build wooden raised walkways, while clay will be used to landfill street portions. People queue to take water and to use the public telephone. Some go to the Icoaraci Village to buy açaí.

6.5.4. Sub–conclusion to ligatures

This section was dedicated to the observation of street life, as an expression of inhabitants' ligatures in relation to space. It started with consideration of the potential that the urban form of the case study areas offers to inhabitants' social interaction. The relationship between streets, block, plots and buildings (e.g.: houses opening straight into streets, setbacks which work as alleys to inner block occupation, attached typologies) creates a system of barriers and permeabilities, gradually differentiated by hierarchies previously explained (section 6.4) and potentials (section 6.5). This system is still flexible enough to allow diverse patterns of behaviour, according to prevalent social codes; outsiders have access all over the areas, but under progressive control of inhabitants. The intensity of control distinguishes the most segregated areas from the most integrated and affects commercial activities, which are more intense in the city centre and limited to one street or a few street junctions in the expansion area.

In the most consolidated (and usually spatially better integrated, e.g.: Control 1and Paracuri) areas there is a stronger interaction between inhabitants and outsiders and both contribute to street life, either along streets or concentrated at street junctions. In the less consolidated areas (usually more segregated; e.g.: Arthur Bernardes and Tucunduba) interaction is more restricted to inhabitants along *'estivas'*, resulting in social segregation and restricted availability of references for urban codes of behaviour. In intermediary stages (e.g.: Santa Cruz), streets work as extensions of the house space, and are places of information exchange and shared activities, especially related to leisure or informal activities.

Inhabitants, as users of open spaces, can be broadly classified into two profiles. One is 'aspirers', who are looking forward to improvements, and aim to control unwanted interaction through distance, pursuing a home-centred life style and practising co-operation as courtesy; they are either children of original inhabitants or better-off new comers. The other is of 'conformers' who rely on strong spatial–social networks, and present a street-oriented life style, accepting present conditions either by managing constraints with flexibility and creativity, or by being indifferent and careless. Attitudes might be associated with conditions of access to income, length of time in the settlement and previous living conditions.

From observation of the use inhabitants make of space, four main categories of activity were identified: work, consumption, entertainment and caring (either of people or space). In Santa Casa commercial activities are intense all through the week, house improvement is noticeable; the two main profiles of inhabitants can be observed on the streets, involved in amusement and street maintenance and religious practice. In Santa Cruz commercial activities are intense only on weekends and Friday evenings; it seems to be a predominantly residential area. Differences between inhabitants are less evident on streets; everybody seems to be involved in street watching. Tucunduba is intermediate between the previous cases regarding commercial activity - not so intense, but present over the whole week; there is a strong differentiation of inhabitants' profiles, and solidarity among inhabitants concerned about safety, especially in the most segregated streets.

Paracuri has places for specialised activities (related to pottery) and very localised commercial activities; there is some differentiation of inhabitants' profiles, but all are involved in street surveillance. In Arthur Bernardes the environment of the road was confirmed as very different from that of the internal streets. The first presents intense commercial activity and diversity of users, everything is undergoing building work, with intense building activity during weekends. More than in any other case study area, the space of the street is an extension of the private space.

In all areas, streets are fundamental to inhabitants' lives, confirming the theories presented in the sections 4.3.3. Through their configuration they provide economic opportunities, and social references to them, though the interaction among different internal groups and between inhabitants and outsiders. However, most activities performed on the streets lack physical amenities and conflict with traffic especially car traffic. Outsiders who usually drive through areas located in the city centre have no wish to take part in the life that happens there, to the disadvantage of inhabitants who could benefit from such contact. In the expansion area, Paracuri is a quiet and stable place, and Arthur Bernardes settlements are still struggling to have proper streets.

6.6. Conclusion

This chapter investigates positive and negative contributions of space to life chances of invaded areas' low income inhabitants; in particular it examines the extent to which location, timescale and configuration affect inhabitants' life chances. The evidence about what factors enhance life chances, displayed in previous sections, can be summarized as follows in Table 6.33:

Table 6.33. Summary of the chapter's findings			
	Location	Timescale	Configuration
Entitlement	Potential for integration to the city (particularly in Belém) and to development of commercial activities	Globally follows location, locally follows configuration	Connections with the city, settlements inner structure
Provision	Land value, density and access to physical and social infrastructures	Patterns of change: globally follow location; locally follow configuration	Building typologies; scale of grids, correspondence between type of streets, street condition and street width
Ligatures	Density, intensity of street co-presence	Bonds between inhabitants; synchronicity between inhabitants achievements and settlement's physical change	Built form can enhance street co-presence and solidarity levels among inhabitants.

From this evidence is possible to answer the research question posed at the beginning of this chapter as follows:

Location, timescale and configuration make a contribution to life chances through the process of consolidation. The extent of this contribution depends on how these variables are interrelated. Access to income and education is strongly affected by location, which restricts or enlarges availability of sources of jobs, and better choices of schools, of critical importance in a context of welfare unreliability. However, by the same token this access is affected by other factors, especially configuration. In terms of access to income and education, configuration defines local scales of centrality and can launch the potential to access diverse scales of activities, which might favour street vending and casual jobs, and attract social infrastructure such as schools and health centres. Timescale affects locations through city growth, tending to improve accessibility in the oldest areas globally. However, this is not always true locally; depending on characteristics of configuration, transformations might be hastened or not occur at all.

Access to housing and a habitat is affected by location which is reflected in cost, and low income people look for minimum cost. This usually results in occupation of unwanted or non-appropriated areas with a good potential of accessibility to commercial areas within the city. Here a conflict between location and configuration is established, since the best location was offered through occupation of the worst sites. This imposed an initial condition of precariousness on the informal settlements, which require a great quantity of investment to achieve consolidation, not always possible due to the economic limitations of the inhabitants and land market mechanisms in effect in the city.

The contribution of timescale to this aspect of location is of critical importance. Over time, settlements may be aggregated and acquire greater importance in the spatial and social structure of the city. Locally, time is associated with configuration, and contributes to the enhancement of local

structures of streets and to the occurrence of upgrade in selected streets. This combination works with a potential to greater centrality, and generates a hierarchy of streets, usually flexible enough to give a place to a wider range of activities and income groups, spreading the consolidation outwards.

Conversely, the partnership between configuration and timescale affects social interaction, networks and motivations in the community. Streets are the main place where social interaction happens, and the intensity and diversity of social contact depend on the existing hierarchy of space. The most integrated spaces favour the presence of both inhabitants and outsiders, the intermediate spaces are mostly used by an area's neighbourhood, while the most segregated spaces are often controlled by local inhabitants. Timescale favours the creation of a socio-spatial network, to the benefit of those who have the neighbourhood as a social asset to overcome everyday difficulties, and also favours the introduction of new references through the newcomers.

Drawing on what has been explained, it is possible to say that location and configuration have similar degrees of importance to life chances (as global and local spatial scales). However, the fourth dimension, given by time, is essential to balance the initial trade-off between location and a site's physical conditions. Changes in the city, actions of other agents and social interaction among inhabitants are developed and incorporated into this equation through time. The way this happens has a great deal of importance for inhabitants' accomplishments in life. How inhabitants perceive the influence of the place where they live on their life chances, and benefit from it, is discussed next.

Chapter 7
Inhabitants' Perception and Achievement of Life Chances

Chapter 7 Inhabitants' perception and achievement of life chances

7.1. Introduction

This chapter first presents socio-spatial data about Belém, to offer the background to case study data. Then the case studies' socio-economic profiles are presented, in order to characterise their households' and inhabitants' prospects. Once the city's and research areas' background is established, the constitutive elements of life chances (entitlement, provision and ligatures) are analysed according to selected variables. Each element is closely observed, in order to answer the second research question of this thesis: **to what extent does the perception and / or achievement of life chances of inhabitants vary according to the place where they live?**

7.2. General life standards in Belém

7.2.1. Socio-economic data

The majority of Belém's population are adult (more than 20 years); differences between the number of males and females has become more evident in adulthood; the number of women increases at a higher rate than the number of men (Table 7.1). This might be a result of urban violence and migration patterns. 42.7% of the present-day population are migrants, most of them (32.5%) coming from the state of Para, of which Belém is the capital. The number of schooling years of people over 10 years of age shows that most (55.8%) have received fundamental education, achieved by eight years of school attendance and whose provision is established as an obligation of the government by the Brazilian Constitution enacted in 1988. The proportion of inhabitants with intermediate education, 11 years of school attendance, is 28.4%; and of those who are attending or have completed higher education 9.4% (Table 7.2).

Table 7.1. **Population distribution in Belém according to gender and age** (percentages of total)

Age	Male	Female	Total
Up to 4	4.4	4.8	9.2
5 – 9	4.7	4.9	9.6
10 – 14	4.9	4.5	9.4
15 – 19	5.2	6.4	11.6
20 – 39	15.9	18.8	34.7
40 – 64	9.6	11.5	21.1
+ than 65	1.7	2.7	4.4
Total	46.25	53.75	100.0

Source: IBGE, PNAD 1999. Belém Metropolitan Region, p.60

Fifty five percent of the population over 10 years of age has access to income; of these, 37.1% earn up to three minimum wages (one minimum wage corresponds to $ 75.00 per month). This indicates that low income people are the majority in the city. Moreover, among the poor, the number of women in the band of up to one minimum wage is nearly double the number of men. These figures

indicate that there are possible relationships between poverty, migration patterns, age and gender in Belém; this may be, to some extent, the result of the role of the city within its regional context, presented in chapter three, since it is the only metropolis in the north of Brazil (Tables 7.3 and 7.4).

Table 7.2. **Number of schooling years of people from 10 years of age upwards living in Belém** (percentages of total)

Schooling years	Male	Female	Total
Illiterate/ less than 1	2.4	3.3	5.7
Up to 4	11.5	12.5	24.0
5 – 8	14.3	17.5	31.8
9 – 11	12.8	15.6	28.4
+ than 12	4.6	4.8	9.4
Not informed/unknown	0.3	0.4	0.75
Total	45.9	54.1	100.0

Source: IBGE, PNAD 1999. Belém Metropolitan Region. p.66

Table 7.3. **Number of minimum wages of people from 10 years of age upwards living in Belém** (percentages of total)

Income	Male	Female	Total
Up to 1 MW	5.1	9.5	14.6
1 – 3 MW	12.5	10.0	22.5
3 – 5 MW	3.9	2.4	6.3
5 – 10 MW	4.4	2.4	6.8
+ than 10 MW	3.1	1.9	5.0
None	16.6	27.8	44.4
Not informed	0.3	0.1	0.4
Total	45.9	54.3	100.0

Source: IBGE, PNAD 1999. Belém Metropolitan Region. p.64

Table 7.4. **Origin of people from 10 years of age upwards living in Belém** (percentages of total)

Born in Belém	Born in Pará	Born in another state	Not informed
57.28	32.51	10.2	0

Source: IBGE, PNAD 1999. Belém Metropolitan Region. p.63

7.2.2. Socio-spatial data

These inequalities are evident in socio-economic data in Belém, and are spatially expressed through centre-periphery segregation (Fig 7.1). Exploratory statistical tests carried out by Lima (2000) found that in Belém income predicts infrastructure provision and amount of living space (p. 157) (amount of living space depends on income and infrastructure provision means more expensive plots). Moreover, correlation of income and indicators of amount of living space have suggested that infrastructure provision creates locational advantages and favours socio-spatial segregation within the city (p.159).

Lima's (2000) analysis of the city configuration has shown that the city has problems of accessibility because of the discontinuity of layout between the centre and the expansion area (ibid., p. 193), negatively affecting the spatial entitlement dimension of inhabitants' life chances. There are few links connecting the centre to the rest of the city, and these links are not well integrated into the

layout that has been formed by new developments and invasions in the expansion area (ibid., p. 193).

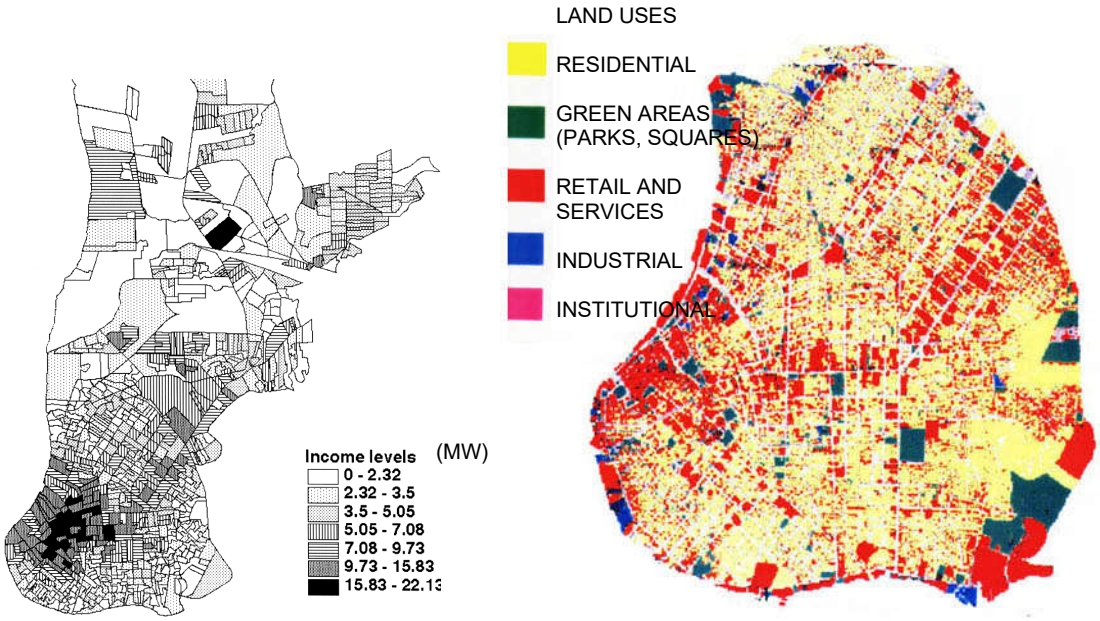


Fig. 7.1. Distribution of income levels and land uses in Belém. Left: Map of average income received by households (measured by number of minimum wages received per month per household) per census sector in Belém, 1991. Source: data from IBGE, 1991 and map from CODEM, 1986; and CELPA 1998. Right: Map with distribution of land use in the city centre in 1990. Source: JICA, 1992.

Socio-spatial segregation is manifested in the centre and in the expansion area; within the expansion area, income and education clearly predict infrastructure and amount of living space, indicating limitations of provision (better educated inhabitants usually have better income and access to better living conditions). Meanwhile, in the centre there is a fine-grain scale of segregation, thanks to the trade-offs between accessibility and environmental conditions chosen by those who live on previously flooded areas. The centre's dense and compact configuration allows a more effective utilisation of the infrastructure available, and its grid interconnects the different integrated cores (subcentres) and delivers mobility to different social groups (ibid., p. 193).

Lima (2000) has also highlighted the importance of political motivation for patterns of infrastructure provision, and the creation of a taxation cycle by the local government, through which taxation is indirectly related to income because of the locational advantages it reflects. Taxation reinforces the socio-spatial segregation created by the distribution of social groups in the city (ibid.,p. 195); conversely, the existence of informal settlements in the centre, which are not subjected to taxation, is an example of the compensation delivered by the centre's grid to offset against spatial inequality. This compensation is not as effective in the expansion area, where socio-spatial inequality is more conspicuous (ibid.).

7.3. Case study areas' socio-economic profile

According to questionnaire responses, the proportion of males and females in case study areas varies. There are more women in Control 1 area and in and Santa Cruz areas, more men in Tucunduba, Paracuri, Arthur Bernardes and Control 2 areas, and a balance between genders in Santa Casa. This indicates a possible relationship between consolidation level and number of women, since poor single women are more often accepted to live with middle and upper class families as maids, and also move house after marriage more often than men. It seems that the poorest invasions are predominantly male environments (Table 7.5). For assistance in reading the tables presented in this chapter please unfold the map which shows the case study areas, located in Appendix A.

Table 7.5. **Gender per case study area** (99.5% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
Gender	Santa Casa	Santa Cruz	Tucundub a	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Male	50.3%	48.4%	**53.1%**	46.2%	**52.2%**	**52.2%**	50.7%	50.3%
Female	49.7%	**51.6%**	46.9%	**53.8%**	47.8%	47.8%	49.3%	49.7%
Total	100%	100%	100%	100%	100%	100%	100%	100%

The majority of households surveyed are constituted of nuclear families (two generations living together - parents and their children), with five, four and three inhabitants. There are a few cases of one-person households in Santa Casa, Santa Cruz, Paracuri and Arthur Bernardes; while more than seven person households are more frequent in Santa Cruz, occurring in a few cases in all other areas except Arthur Bernardes (Table 7.6). The subdivision of a plot or house to benefit a relative is more frequent in Santa Cruz than in other areas. In the expansion area there are more cases of split families headed by women with children (children in Arthur Bernardes, teenagers in Paracuri), who are restarting life at a lower standard. When the family already lives in the invasion area at the time of a divorce, the original house may be divided to accommodate the new situation (fieldwork, 2000).

Table 7.6. **Household size per case study area** (92.2% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
Household Size	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
0 *	-	-	-	-	3.3%	4.2%	6.3%	1.3%
1	2.9%	4.9%	-	-	3.3%	4.2%	-	2.2%
2	14.7%	7.3%	-	2.6%	10.0%	8.3%	6.3%	6.6%
3	5.9%	**24.4%**	6.8%	17.9%	**23.3%**	**25.0%**	18.8%	16.7%
4	**23.5%**	12.2%	18.2%	20.5%	20.0%	20.8%	**31.3%**	19.7%
5	14.7%	22.0%	**31.8%**	**23.1%**	20.0%	33.3%	12.5%	**23.2%**
6	11.8%	2.4%	13.6%	20.5%	3.3%	4.2%	6.3%	9.6%
7	8.8%	7.3%	18.2%	7.7%	10.0%	-	12.5%	9.6%
8	8.8%	2.4%	-	-	-	-	-	1.8%
9	2.9%	2.4%	4.5%	2.6%	3.3%	-	-	2.6%
10	-	2.4%	4.5%	-	-	-	6.3%	1.8%
11	-	4.9%	-	2.6%	3.3%	-	-	1.8%
12	2.9%	2.4%	-	2.6%	-	-	-	1.3%
13	-	2.4%	-	-	-	-	-	0.4%
15	-	2.4%	2.3%	-	-	-	-	0.9%
19	2.9%	-	-	-	-	-	-	0.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%

* Closed houses, of houses occupied only during day-time, usually used as a work place.

Santa Cruz and Control 1 have more variety of household size, presenting cases of one-person households and of up to four generations living together (Table 7.7). Big nuclear families and extensive families occur in Santa Casa, while in Arthur Bernardes families are probably smaller but with some cases of up to three generations living together. The middle class area of Control 1 has more cases of more than two generations living together than any case study area. This indicates that there is a tendency for younger generations to stay for longer in relatives' houses within the city centre.

Table 7.7. **Cohabitation of generations per case study area** (75.3% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
Household type	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
One-person	3.6%	5.8%	-	-	-	6.1%	-	2.3%
Couples	10.2%	5.8%	-	-	4.0%	6.1%	-	4.0%
Two generations	**58.7%**	**63.7%**	**69.1%**	**63.8%**	**73.0%**	**76.5%**	**73.0%**	**66.7%**
Three generations	27.5%	21.0%	30.9%	33.3%	23.0%	11.5%	26.9%	25.9%
Four generations	-	3.2%	-	2.9%	-	-	-	1.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Santa Casa, Control 1 and Santa Cruz have the highest proportion of inhabitants who came from the same district (50%, 43% and 21% of the surveyed areas populations respectively). Arthur Bernardes has the highest proportion of inhabitants who came from another district of Belém (69% of the surveyed area's population). Tucunduba has the highest proportion of inhabitants who came from another city of Para State (50% of its surveyed population) (Table 7.8). This might indicate that migrants from Para State, where Belém is the capital, prefer to settle close to a river bank in the centre rather than in the expansion area.

Table 7.8. **Place of origin per case study area** (97.4% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
Place of origin	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Belém, same district	**50%**	**43.9%**	21.4%	**46.2%**	16.7%	8.7%	18.8%	32.0%
Belém, another dist.	23.5%	39.0%	28.6%	41.0%	**50.0%**	**69.6%**	**56.3%**	**40.9%**
Other city within the state of Para	23.5%	14.6%	**50.0%**	10.3%	23.3%	21.7%	6.3%	23.1%
Other city in another state	2.9%	2.4%	-	2.6%	10.0%	-	18.8%	4.0%
Total	100%	100%	100%	100%	100%	100%	100%	100%

The Control 1 population has the smallest proportion of children and the highest proportion of people over 41 years of age: the former population is smaller and the latter higher than the whole city percentages (5% of Control 1's surveyed population is of children less than 5 years of age, and 13% is over 65 years of age). Santa Cruz has more children up to 11 years of age than the other areas (3.8% of the whole sample against 3.3% in Santa Casa and inTucunduba, 2.6% in Paracuri, 2% in Arthur Bernardes and 2.3% in Control 2). Tucunduba has more teenagers and adults up to 40 years old than the other areas (4.4% of the whole sample, against 2.7% in Santa Casa and Santa Cruz, 2.5% in Control 1, 2.0% in Paracuri, 1.3% in Arthur Bernardes and 0.4% in Control 2). The proportion of children and teenagers in all case study areas is not very different from their proportion in the whole city. The proportion of young adults (from 19 up to 40 years of age) in the case studies is higher than in the city, and the proportion of middle aged (from 41 up to 65 years of age) people is smaller in case study areas than in the city. The proportion of people over 65 years of age is smaller than in the city, except in Control 1 and the Santa Casa case study, the oldest areas surveyed (Table 7.9).

Table 7.9. **Age per case study area** (98.9% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
Age	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Up to 5	8.3%	10.5%	6.7%	5.7%	11.6%	13.3%	8.0%	8.7%
6 – 11	12.7%	9.6%	8.2%	5.2%	10.1%	13.3%	28.0%	10.6%
12 – 18	17.1%	14.2%	20.0%	15.0%	16.7%	16.7%	6.7%	16.1%
19 – 40	**36.5%**	**41.6%**	**44.3%**	**33.7%**	**42.0%**	**46.7%**	**32.0%**	**39.9%**
41 – 65	19.3%	20.1%	16.9%	27.5%	15.9%	10.0%	16.0%	18.9%
+ 65	6.1%	4.1%	3.9%	13.0%	3.9%	-	9.3%	5.8%
Total	100%	100%	100%	100%	100%	100%	100%	100%

The informal settlements are the home of young adults who want to settle with their families. Questionnaires have shown that adults make a more focused use of space; they go to their workplace, to the open market and to the church. Teenagers are more aware of what happens in the district and where places are located (they recognised places from photos more easily); elders preserve more conservative values carried from the countryside, such as the wish to live in a quiet

place, close to nature, and raise animals and plants; children are the most vulnerable group, due to the precarious condition of plot and street space (fieldwork, 2000).

Half the population surveyed is economically active. Among workers, the majority of employees in the public sector (which have more stability in the Brazilian labour context) lives in Control 1 and Santa Casa, a fact contrasting with the non-existence of such workers in Arthur Bernardes settlements. Employees in the private sector are more frequent in Tucunduba and Santa Cruz. The percentages of employment in the public and private sectors indicate easier access to the formal labour market in the city centre than in the expansion area. Professional self-employed have a higher frequency in Control 1, where they often are big shop owners and graduate professionals, e.g.: lawyers; followed by Santa Cruz and Santa Casa, where skilled self-employed are small shop owners, craftsman and workers (plasterers, carpenters, bricklayers). Low skilled self-employed are more concentrated in Tucunduba (often street vendors or people involved with snack preparation and sale) and in the expansion area. Retired people and pensioners are more frequent in the city centre; most of them are in Control 1, followed by Santa Casa; in the poorest areas they usually are the only people in the household to have regular income (paid by the government) (Table 7.10).

Table 7.10. **Occupation per case study area** (90.5% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
Occupation	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Public sector	7.5%	3.0%	5.1%	8.7%	2.4%	-	1.5%	4.8%
Private sector	8.0%	16.6%	16.7%	12.5%	15.3%	16.4%	6.1%	13.7%
Professional Self employed	9.8%	9.0%	3.4%	11.4%	9.7%	6.8%	6.1%	8.1%
Low skilled self employed	12.6%	6.0%	23.5%	4.9%	15.3%	16.4%	19.7%	13.5%
Diary rate job	-	1.5%	-	-	0.8%	-	-	0.4%
Domestic job	1.7%	2.0%	2.1%	2.2%	2.4%	2.7%	2.7%	2.1%
Landladies	-	-	-	-	-	-	3.0%	0.2%
Retired/pens.	8.0%	6.0%	5.1%	15.2%	3.2%	1.4%	4.5%	7.0%
Housewife	6.9%	7.5%	6.4%	10.3%	8.9%	8.2%	7.6%	7.9%
Unemployed	2.9%	13.6%	3.0%	7.6%	12.1%	24.7%	9.1%	8.7%
Student	**42.5%**	**34.7%**	**34.6%**	**27.2%**	**29.8%**	**23.3%**	**40.9%**	**33.7%**
Total	100%	100%	100%	100%	100%	100%	100%	100%

The proportion of full-time students is higher in the city centre than in the expansion area case studies (42.5% of Santa Casa's surveyed population; 34.7% of Santa Cruz; 34.6% of Tucunduba's; 27.2% of Control 1's; 29.8% of Paracuri's; 23.3% of Arthur Bernardes's; 40.9% of Control 2's). Cases of individual income being uncertain or unpredictable are more frequent in the expansion area than in the city centre (13% of Santa Casa's surveyed population; 11% of Santa Cruz's; 23% of Tucunduba's; 7% of Control 1; 26% of Paracuri's; 21% of Arthur Bernardes and 26% of Control 2). This indicates these areas' possible reliance on the informal labour market. There is no case of an individual income above 10 minimum wages in the expansion area case studies or in Santa Casa (Table 7.11). This could be an indicator of the prevalence of lower incomes in these areas;

differently from the expansion area, households in Santa Casa are usually bigger and have easier access to the formal market.

Table 7.11. **Income per case study area** (97.8% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
Income bands	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Up to 1 MW	11.0%	11.1%	8.2%	9.5%	8.7%	9.5%	6.8%	9.5%
1 – 3 MW	22.1%	10.6%	13.3%	12.2%	10.1%	10.7%	8.2%	13.1%
3 – 5 MW	0.6%	3.7%	4.3%	7.9%	0.7%	1.2%	6.8%	3.7%
5 – 10 MW	0.6%	2.8%	2.0%	11.1%	-	1.2%	-	3.0%
+ 10 MW	-	0.5%	0.8%	5.8%	-	-	-	1.2%
Uncertain	13.3%	11.1%	23.0%	7.4%	26.1%	25.0%	26.0%	17.3%
None	51.9%	60.4%	45.7%	45.5%	52.2%	52.4%	52.1%	51.1%
Unknown	0.6%	-	2.7%	0.5%	2.2%	-	-	1.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Nursery care was found in Control 1, Santa Cruz and Tucunduba areas. The service is more likely to be private in the former and provided by the government in the latter; illiteracy is higher among Arthur Bernardes and Paracuri populations,17% and 13% respectively, than elsewhere. Santa Casa's and Tucunduba's illiteracy proportion is 10%, Santa Cruz's is 9%, Control 1's 6% and Control 2's 3%. Only the Control areas do not have illiteracy levels much higher than the whole city proportion (5.7%); however, differences between centre and expansion area indicate that it is more difficult to continue education for those who live in the Arthur Bernardes case study area. The majority of the surveyed population has fundamental education (8 schooling years); intermediate education (11 schooling years) is more frequent in Control 1 and Santa Cruz, and has similar levels in other case study areas except for Arthur Bernardes; higher education (more than 11 schooling years) is more frequent in Control 1 than in other areas and does not occur in Arthur Bernardes or Control 2. Prospects of education are higher in the city centre than in the expansion area (Table 7.12).

Table 7.12. **Number of schooling years per case study area** (97.1% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
Years/situations	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Illiterate	10.0%	9.1%	10.3%	6.2%	12.2%	17.6%	2.7%	9.6%
Up to 4	26.7%	27.9%	17.4%	7.8%	20.6%	30.8%	**32.4%**	21.7%
4 – 8	**39.4%**	27.4%	**46.6%**	30.1%	**39.7%**	**42.9%**	29.7%	**36.9%**
8 – 11	20.0%	**31.7%**	24.1%	**36.8%**	25.2%	7.7%	28.4%	26.0%
+ 11	1.7%	3.4%	0.8%	18.7%	0.8%	-	-	4.3%
Unknown	2.2%	-	0.4%	-	1.5%	1.1%	5.4%	1.1%
Nursery	-	0.5%	0.4%	0.5%	-	-	-	0.3%
Special edu.	-	-	-	-	-	-	1.4%	1.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%

The occurrence of schools, hospitals and commercial areas in Tucuduba and Paracuri basin is presented in Fig. 7.2 to 7.4. Despite the number of schools available in both areas, inhabitants

MARKETS:

- (A) GUAMÁ MARKET AND OPEN MARKET
- (B) TERRA FIRME MARKET AND OPEN MARKET
- (C) SÃO BRÁS MARKET AND OPEN MARKET
- (D) TEÓFILO CONDURU OPEN MARKET
- (E) AUGUSTO CORRÊA OPEN MARKET
- (F) ACATAUASSÚ OPEN MARKET

SQUARES:

- (01) BRUNO DE MENEZES SQUARE
- (02) FREI DANIEL DE SARAMATE SQUARE
- (03) JARDIM DAS ORQUÍDEAS SQUARE
- (04) OLAVO BILAC SQUARE
- (05) TENENTE SOUZA SQUARE
- (06) CONJUNTO ALACID NUNES'S SQUARE
- (07) IAPI'S SQUARE
- (08) CAIXA D'ÁGUA SQUARE
- (09) LEITURA SQUARE
- (10) OPERÁRIO SQUARE
- (11) LAURO SODRÉ SQUARE
- (12) JOSÉ SIDRIM SQUARE

LEGEND:

- PAVED STREET
- CONCENTRATION OF COMMERCE
- MARKET
- OPEN MARKET
- MARKET AND OPEN MARKET
- SQUARE

SCALE BAR
0 100 250 500 m

FIG. 7.2: DISTRIBUTION OF COMMERCIAL ACTIVITIES AND SQUARES IN TUCUNDUBA BASIN
Source: CELPA, 1998; PMB, 1999

LEGEND:
KEY TO SCHOOLS ACCORDING TO LEVEL OF EDUCATION PROVIDED

- NURSERY AND KINDERGARTEN
- PRIMARY AND FUNDAMENTAL EDUCATION
- INTERMEDIATE EDUCATION
- FUNDAMENTAL AND INTERMEDIATE EDUCATION
- SPECIAL EDUCATION
- NOT SPECIFIED

HEALTH FACILITIES:

- HEALTH CENTER
- HOSPITAL
- EMERGENCY HOSPITAL
- AIDS CLINIC

- FEDERAL
- STATE
- CITY
- PRIVATE

SCALE BAR
0 100 250 500 m

FIG 7.3: EDUCATIONAL AND HEALTH PROVISION - TUCUNDUBA BASIN

Source: CELPA, 1996; PMB, 1999

LEGEND:

- PAVED STREET
- CONCENTRATION OF COMMERCIAL ACTIVITIES
- MARKET
- OPEN MARKET
- MARKET AND OPEN MARKET
- SQUARE

SCALE BAR

0 100 250 500 m

FIG 7.4: DISTRIBUTION OF COMMERCIAL ACTIVITIES AND SQUARES IN PARACURI BASIN

Source: CELPA, 1998

LEGEND:

HEALTH FACILITIES:

- FEDERAL
- STATE
- CITY
- PRIVATE

EDUCATIONAL FACILITIES:

- FEDERAL
- STATE
- CITY
- PRIVATE

SCALE BAR

0 100 250 500 m

FIG 7.5: EDUCATION AND HEALTH PROVISION IN PARACURI BASIN

Source: CELPA, 1998

complain about shortage of places and quality of education. In Tucunduba basin the shortage affects young children and in the expansion area all ages. This means that inhabitants do not always have a place in the school nearest to their houses. Health care presents similar problems, despite the physical existence of either health centres or private hospitals associated with the public system in the expansion area, the service is said to be poor. In the city centre there are similar complaints; however this is mitigated by the existence of federal hospitals which offer a better service to the population.

Well-established commercial areas are easily reached by Santa Casa's and Tucunduba's inhabitants, and are not too far from Santa Cruz. In the expansion case study areas adjacent commercial areas are less strong or more specialised (the street that demarks the old village specialises in pottery). Important market and open markets are located far away from the settlements, requiring movement by bicycle rather than on foot. Green areas are scarce in Tucunduba basin, where they are rare and small, despite the existence of the river. In Paracuri basin, the old village has a promenade along the Bay bank and a few squares; the river banks behind the settlements are actively used as spaces of leisure.

7.3.1. Sub-conclusion to socio-economic profile

The case study areas have different socio-economic profiles. In the most integrated areas, located in the city centre, there are more females than males or a balance between genders, while there are more males in other case study areas. Santa Cruz and Control 1 presents a wider variety of household size. Santa Cruz contains most of the extended families and plot subdivisions to benefit relatives in the survey. The expansion area has more single parent families and no households with more than seven people.

Generally there is a tendency in the city centre for younger generations to stay longer in relatives' houses, especially in Control 1. The latter, Santa Casa and Santa Cruz present the highest proportion of inhabitants who came from the same district, a fact usually associated with links of kinship or close friendship. Arthur Bernardes presents the highest proportion of inhabitants who came from other districts within the city (this is also true of other areas located in the expansion area). Tucunduba presents the highest proportion of inhabitants who came from another city of Pará State (migrants from the countryside).

Distribution of age groups is also diverse. Santa Cruz has more children than other areas, and Tucunduba has more teenagers, contrasting with Control 1 and Santa Casa, which have more mature adults and also more retired and pensioners than other areas. The proportion of young adults in all case study areas is higher than in the city as a whole, whereas the overall proportion of

elders is smaller than in the city. Each age group has a different relationship to space; adults usually move along the same routes, while teenagers explore more places and alternative routes. The elders are more concerned about plot utilisation, trying to rescue a countryside life-style. Children seem to be the group most vulnerable to the space's lack of infrastructure.

Half the population is economically active in the case study areas overall. The city centre presents the greatest concentration of workers formally employed. Workers employed in the public sector are found in Control 1 and Santa Casa and do not exist in Arthur Bernardes. Professional self-employment is infrequent only in the most segregated areas, Tucunduba, Arthur Bernardes and Control 2, where lack of professional skills leads workers to casual jobs and street vending.

The city centre has the majority of full-time students, and the expansion area has the majority of workers with unpredictable or uncertain income. Neither Santa Casa nor any case study in the expansion area has individual incomes above 10 MW; however, in Santa Casa, households are bigger and have easier access to sources of jobs, meaning that income constraints are more severe in the expansion area than in the city centre.

All case study areas have a higher proportion of illiteracy than the city as a whole. Illiteracy is even higher in the expansion area, and the number of schooling years is higher in the city centre. The prevalence of fundamental education (up to eight schooling years) in Arthur Bernardes might be an outcome of the concentration of social infrastructure (education and health care facilities) in the city centre in quantitative and qualitative terms. Equivalent shortage of choices occurs in the expansion area in the supply of services and goods.

Summing up, case study areas' inhabitants have heterogeneous profiles, dependent on location. This is due to the city's socio-spatial inequalities, expressed by a fine grain segregation inside the city centre and a more crude one between centre and periphery. The most consolidated areas have social profiles more similar to city averages, while less consolidated areas tend to present more disadvantaged social profiles.

7.4. Internal perception and achievement of life chances

In a socio-economic context of poverty it is hard to isolate the contribution of entitlement, provision and ligatures to achieved and perceived life chances. Poor people need first of all to improve access to income, and in order to do so they need physical and social infrastructure as a means to better health and education. They need access to housing in a broad sense; they need a healthy and safe environment, in a location able to offer easy access to available jobs, schools, health care,

leisure and their social network, which usually provide information about opportunities and support to their every-day lives.

According to the Brazilian Constitution (1988), all Brazilians have the status of citizens, and therefore, right of access to education, health care, minimum income and housing, among other basic rights. Nevertheless there are quantitative and qualitative constraints on the provision of means to put the law into effect in Brazilian cities, and the desired universality of entitlements is not achieved. This raises vast social and economic discussions which are outside this thesis' scope. For this reason, specific variables were selected from the socio-economic profile and presented above to assess inhabitants' achievements and perception of the potential for life chances delivered by the space where they live, according to the constitutive components of the concept (entitlements, provision and ligatures).

7.4.1. Entitlement conditions

7.4.1.1. Access to education

In Control 1, children and teenagers are completing schooling years at the expected ages. A few young adults (19-40 years old) have dropped school after fundamental education (8 years of schooling); most have or are attending courses of intermediate education (8-11 years of schooling) and one quarter of them has or is attending courses of higher education (more than 11 years of schooling. Mature adults are divided over all levels of education, from illiteracy up to more than 11 years of schooling, but the majority has fundamental and intermediate education. The oldest are more concentrated in the fundamental education level (Table 7.13).

Table 7.13. **Age and schooling in Control 1's population** (95.5% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
illiterate	**90.9%**	-	-	-	3.8%	-	6.3%
Up to 4	-	**50%**	3.4%	-	13.2%	8.7%	7.9%
4 – 8 years	-	**50%**	**69.0%**	13.8%	22.6%	**52.2%**	30.4%
8 - 11 years	-	-	27.6%	**61.5%**	**34.0%**	21.7%	**37.2%**
+ 11 years	-	-	-	24.6%	26.4%	17.4%	17.8%
Nursery	9.1%	-	-	-	-	-	0.5%
Total	100%	100%	100%	100%	100%	100%	100%

In Santa Casa a few children start school before six years of age, and most of them are completing primary education (up to 4 years of schooling) at the expected age. Teenagers have finished primary education and are progressing to intermediate school at the expected time. Young adults are either attending or have finished fundamental and intermediate education, with cases of access to higher education. Mature adults range from illiteracy up to the intermediate level of education (the majority have completed fundamental education). Most inhabitants over 65 years have only primary education. Fundamental education is more frequent in adults and adolescents, and is the level for the majority of the population, indicating a high proportion of school leaving at this level. However,

the higher proportion of adults than teenagers attending or pursuing intermediate education possibly indicates a return to school among young adults, who are achieving higher levels of education at a later age. From interviews it was possible to identify undergraduate students as children of families who settled in the area earlier than most. Inhabitants are happy with the availability of schools within the district, but fear teenage gang action in some public schools (Table 7.14).

Table 7.14. **Age and schooling in Santa Casa's population** (99.4% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
illiterate	**80.0%**	4.3%	-	1.5%	8.8%	9.1%	10.0%
Up to 4	20.0%	**69.6%**	12.9%	10.6%	32.4%	**72.7%**	27.2%
4 – 8 years	-	26.1%	**74.2%**	39.4%	**41.2%**	9.1%	**38.9%**
8 - 11 years	-	-	12.9%	**40.9%**	11.8%	9.1%	20.0%
+ 11 years	-	-	-	4.5%	-	-	1.7%
Unknown	-	-	-	3.0%	5.9%	-	2.2%
Total	100%	100%	100%	100%	100%	100%	100%

In Santa Cruz children and teenagers complete primary and fundamental education at the expected ages. Half of young adults are either attending or have completed intermediate education, and there are cases of attendance at higher education establishments. Mature adults range from illiteracy to intermediate education, but most frequently have fundamental education. Most inhabitants over 65 have had primary education only. The most frequent level of education is the intermediate, as in Control 1; primary and fundamental education are in equal proportions, and significant numbers indicate continuity of school attendance. Santa Cruz's educational prospects seem to be higher than in any other case study area (Table 7.15).

Table 7.15. **Age and schooling in Santa Cruz's population** (95.0% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
illiterate	**78.9%**	-	-	-	6.8%	11.1%	9.1%
Up to 4	21.1%	**88.2%**	20.7%	14.4%	31.8%	**66.7%**	27.9%
4 – 8 years	-	5.9%	**51.7%**	26.7%	**38.6%**	11.1%	27.9%
8 - 11 years	-	-	27.6%	**51.1%**	22.7%	11.1%	**31.3%**
+ 11 years	-	-	-	7.8%	-	-	3.4%
Nursery	-	5.9%	-	-	-	-	0.5%
Total	100%	100%	100%	100%	100%	100%	100.0

In interviews, parents stressed the importance of having schools easily reached on foot, since it is important not to pay money for transport as a condition of children's school attendance. They also consider that early school leaving is often caused by bad company (violent and idle people), and emphasised adult responsibility for guiding their children towards a better education (fieldwork, 2000).

Most children are attending fundamental school, as are teenagers. Half of young adults have achieved at least intermediate education, most mature adults have either primary or fundamental education. Those older than 65 do not have more than fundamental education; the area has a higher incidence of illiteracy among people over 65 than other case study areas. Primary is the

most frequent level of education in the area. In interview, a mother recognised that her children dropped out of school early in life because of early work; poverty associated with the low quality of schools near-by, and complaints about availability of places, give more than enough motivation for school leaving. Despite negative prospects, when poverty is alleviated, it is possible to return to schools located further away in the district. This may be the reason for the high incidence of access to school by bus in this area (see Table 6.12, in Section 6.3.2.1) (Table 7.16).

Table 7.16. **Age and schooling in Tucunduba's population** (97.7% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
illiterate	**100%**	4.8%	2.0%	1.8%	4.8%	30.0%	10.3%
Up to 4	-	19.0%	17.6%	8.0%	**42.9%**	**40.0%**	17.4%
4 – 8 years	-	**71.4%**	**68.6%**	42.0%	**42.9%**	30.0%	**46.6%**
8 - 11 years	-	-	11.8%	**46.4%**	7.1%	-	24.1%
+ 11 years	-	-	-	1.8%	-	-	0.8%
Unknown	-	-	-	-	2.4%	-	0.4%
Nursery	-	4.8%	-	-	-	-	0.4%
Total	100%	100%	100%	100%	100%	100%	100%

In Paracuri, children are starting school early; most children and teenagers are attending fundamental education, perhaps because they began when the local public school was built[1]. However, the area presents the lowest proportion of teenagers progressing to intermediate school. Young adults range from illiteracy to higher education, with the majority concentrated in the intermediate education level. Most mature adults have basic education and elders do not have more than primary education. Primary education is more frequent among middle- aged adults and elders than in other age bands, demonstrating that the present adults dropped out of school early in life (Table 7.17).

Table 7.17. **Age and schooling in Paracuri's population** (94.9% of interviewees answered this question)

	Up to 5	6 – 11	12 – 18	19 – 40	41 – 65	+ 65	Total
illiterate	**71.4%**	-	4.5%	1.8%	14.3%	20.0%	12.2%
Up to 4	28.6%	38.5%	4.5%	8.9%	**42.9%**	**60.0%**	20.6%
4 – 8 years	-	**61.5%**	**86.4%**	37.5%	19.0%	-	**39.7%**
8 – 11 years	-	-	4.5%	**48.2%**	23.8%	-	25.2%
+ 11 years	-	-	-	1.8%	-	-	0.8%
Unknown	-	-	-	1.8%	-	1.8%	1.5%
Total	100%	100%	100%	100%	100%	100%	100%

The case of a young lady who lives in Paracuri area is illustrative of this situation; she recognised in an interview that she should had studied more before having children. Her mother is illiterate, and she had spent her teenage years playing volleyball on the streets during the day-time, and dancing at parties in the evenings. At present, every time she applies for a job, she does not get it because she has not completed the second (intermediate) course. She was attending an evening course to

[1] In Paracuri the public school is the only facility built as part of an upgrade action; inhabitants think that it has a low standard, and those who can afford it pay for their children to study in private schools. Nevertheless, many children began to study after that new public school was built.

achieve the required level at the time of the interview. Adults always acknowledged the importance of education and regretted their lack of foresight in the past (fieldwork, 2000).

Table 7.18. **Location of attended schools per case study area** (37.2% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Within the district	**81.9%**	48.0%	**71.1%**	50.8%	48.1%	14.3%	**57.6%**	**59.8%**
Outside the district	18.1%	**52.0%**	28.3%	49.2%	**51.9%**	**85.7%**	42.4%	40.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Arthur Bernardes settlements have the highest proportion of illiterate people; only among teenagers are there no illiterates. Children and teenagers are attending primary and fundamental school, but it seems that teenagers are not progressing to intermediate school. The majority of young adults have fundamental education; some are attending or have achieved intermediate education. Mature adults do not have more than fundamental education, the most common level of education among inhabitants. There are complaints about the distance of schools from homes. There are far fewer schools and places available than needed, and students have to go to remoter districts and depend on transport to attend school (see Tables 7.18 and 7.19). Because of this, many children do not attend school in the Arthur Bernardes area.

Table 7.19. **Age and schooling in Arthur Bernardes' population** (96.7% of interviewees answered this question)

	Up to 5	6 – 11	12 – 18	19 – 40	41 – 65	+ 65	Total
illiterate	**100%**	8.3%	-	2.4%	25.0%	-	18.0%
Up to 4	-	**58.3%**	33.3%	28.6%	**37.5%**	-	30.3%
4 – 8 years	-	33.3%	**66.7%**	**52.4%**	25.0%	-	**42.7%**
8 – 11 years	-	-	-	16.7%	-	-	7.9%
+ 11 years	-	-	-	-	-	-	-
Unknown	-	-	-	-	12.5%	-	1.1%
Total	100%	100%	100%	100%	100%	-	100%

In Control 2, children and teenagers are attending primary and fundamental schools, and some teenagers are progressing to intermediate school. Half of young adults are either attending or have achieved intermediate education (a bigger proportion than among teenagers). The majority of mature adults have fundamental education, and little was known about elders. This indicates that whether settlements are formal or informal makes no significant difference in terms of education levels in the expansion area, as it does in the city centre (Table 7.20).

Table 7.20. **Age and schooling in Control 2's population** (98.7% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
illiterate	33.3%	-	-	-	-	14.3%	4.1%
Up to 4	**66.7%**	**71.4%**	**40%**	4.3%	16.7%	-	**32.4%**
4 – 8 years	-	23.8%	**40%**	43.5%	**41.7%**	28.6%	**32.4%**
8 - 11 years	-	-	20%	**52.2%**	33.3%	14.3%	24.3%
+ 11 years	-	-	-	-	-	-	-
Unknown	-	-	-	-	8.3%	**42.9%**	5.4%
Special educ.	-	4.8%	-	-	-	-	1.4%
Total	100%	100%	100%	100%	100%	100%	100%

According to the number of school years, inhabitants of Santa Cruz have the best prospects of all informal area inhabitants, noticeable when compared to Control 1 data. Using the same parameter, Santa Casa's inhabitants have medium prospects and Tucunduba's have lower prospects. In the expansion area, Control 2's inhabitants are disadvantaged compared with those of Control 1; the former's and Paracuri's inhabitants have similar prospects, while Arthur Bernardes' have the lowest prospects of all. This indicates that location is important for the present number of school years, and even more so to the chances of inhabitants' return to school later in life.

7.4.1.2. Access to income

Children do not work in Control 1. Teenagers are largely students; a few of them call themselves unemployed, and self-employed. Young adults are workers in the formal market or are professional or skilled self-employed; maids who live with employer families are between 19 and 40 years of age. Many middle-aged adults are working, as are young adults, but a higher proportion are retired or housewives; the number of unemployed is much smaller in this age band than among young adults. Most people over 65 years of age are retired, although there are a few cases of people employed in the private sector and housewives. People working in the public and private sectors and the retired account for 36.4% of the surveyed population; self-employed account for 16.3%. Students, housewives and unemployed, those who presumably have no income, sum to 45.1% of the surveyed population. The proportion of housewives in Control 1 is greater than the equivalent in the case study areas, indicating a traditional middle class profile (Table 7.21).

Table 7.21. **Age and occupation in Control 1's population** (92.0% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
Public sector	-	-	-	10.0%	17.0%	-	8.7%
Private sector	-	-	-	**20.0%**	15.1%	8.3%	12.5%
Pro-Self employed	-	-	-	18.5%	17.0%	-	11.4%
Low skilled self employed	-	-	3.4%	6.2%	7.5%	-	4.9%
Domestic jobs	-	-	-	6.2%	-	-	2.2%
Student	**100%**	**100%**	**93.1%**	15.4%	-	-	**27.2%**
Retired/pens	-	-	-	-	**18.9%**	**75.0%**	15.2%
Housewife	-	-	-	7.7%	**18.9%**	16.7%	10.3%
Unemployed	-	-	3.4%	15.4%	5.7%	-	7.6%
Total	100%	100%	100%	100%	100%	100%	100%

Children do not work in Santa Casa; they are students, as are most teenagers. A few teenagers call themselves professional self-employed, usually those who have learned craft skills working as trainees in workshops. The proportion of students is higher than in Control 1, and to be a student is the most frequent occupation of young adults (22.7%); the second most usual occupation among young adults is to be self employed[2]; employees in the public and private sectors are also significant. Middle-aged adults do not study and most of them are self-employed. People over 65

[2] Santa Casa has the highest incidence of street vending among all case study areas, confirming the potential found through syntactic measurements; it happens on many scales, from stalls located in busy sidewalks to those located on house verandas. The smaller the scale, the more it seems to be a complementary source of income.

are retired and/or housewives. Workers in the public and private sectors, plus retired and domestic workers, account for 23.5% of the surveyed population; self-employed account for 22.4%. Students account for 42.5% of the population, and housewives plus unemployed sum to 9.8%. This is the most economically stable among the informal case study areas, due to the proportion of inhabitants who have regular access to income (Table 7.22).

Table 7.22. Age and occupation in Santa Casa's population (96.1% of interviewees answered this question)							
	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
Public sector	-	-	-	13.6%	11.4%	-	7.5%
Private sector	-	-	-	15.2%	11.4%	-	8.0%
Pro-Self employed	-	-	6.5%	13.6%	17.1%	-	9.8%
Low skilled self employed	-	-	-	18.2%	**28.6%**	-	12.6%
Domestic jobs	-	-	-	3.0%	2.9%	-	1.7%
Student	**100%**	**100%**	**90.3%**	**22.7%**	-	-	**42.5%**
Retired/pens	-	-	-	1.5%	14.3%	**72.7%**	8.0%
Housewife	-	-	-	7.6%	11.4%	27.3%	6.9%
Unemployed	-	-	3.2%	4.5%	2.9%	-	2.9%
Total	100%	100%	100%	100%	100%	100%	100%

In Santa Cruz, children do not work; teenagers are students, and there are a few cases of domestic workers and of those who call themselves unemployed. Among young adults, employment in the private sector is the most frequent category, followed by the unemployed and students; middle-aged adults are self-employed, housewives, and employees in the private and public sector; a few of them are retired or unemployed. Adults over 65 years of age are self-employed and retired. The formal sector accounts for 27.6% of the surveyed population; occupations relative to the informal sector account for 16.5%; students for 34.7%, unemployed for 13.6%. These plus housewives sum to 55.6% of the surveyed population (Table 7.23).

Table 7. 23. **Age and occupation in Santa Cruz's population** (90.9% of interviewees answered this question)							
	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
Public sector	-	-	-	5.5%	2.3%	-	3.0%
Private sector	-	-	**-**	**29.7%**	13.6%	-	16.6%
Pro-Self employed	-	-	-	8.8%	18.2%	22.2%	9.0%
Low skilled self employed	-	-	-	6.6%	13.6%	-	6.0%
Daily rate jobs	-	-	-	3.3%	-	-	1.5%
Domestic jobs	-	-	3.2%	3.3%	-	-	2.0%
Student	**100%**	**100%**	**90.3%**	17.6%	2.3%	-	**34.7%**
Retired/pens	-	-	-	-	11.4%	**77.8%**	6.0%
Housewife	-	-	-	5.5%	**22.7%**	-	7.5%
Unemployed	-	-	6.5%	19.8%	15.9%	-	13.6%
Total	100%	100%	100%	100%	100%	100.0	100%

Children start school over 6 years of age in Tucunduba; teenagers are already employed in the public and private sectors or self-employed or domestic workers. They are also housewives, pensioners and unemployed, but the majority are students. The majority of young adults are low skilled self-employed, the second most frequent category is employment in the private sector. Among middle-aged adults, the most common occupation is to be a housewife, followed by employment in the private sector. Workers over 65 years of age are retired or working in the private

sector. Formal sector occupations account for 24.2% of the surveyed population; outstanding is the private sector's contribution (16.9%). Self-employment[3] accounts for 27.2% of the population. 34.2% of the surveyed population are students and 9.0% are housewives or unemployed (Table 7.24).

Table 7.24. **Age and occupation in Tucunduba's population** (89.2% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
Public sector	-	-	4.1%	5.5%	9.3%	-	5.2%
Private sector	-	-	8.2%	26.4%	11.6%	10%	16.9%
Pro Self employed	-	-	-	5.5%	4.7%	-	3.4%
Low skilled self employed	-	-	12.2%	**27.3%**	**41.9%**	10%	23.8%
Domestic jobs	-	-	2.0%	2.7%	2.3%	-	2.1%
Student	-	**94.7%**	**67.3%**	23.6%	4.7%	-	**34.2%**
Retired/pens	-	-	2.0%	2.7%	4.7%	**60%**	5.2%
Housewife	-	-	2.0%	3.6%	16.3%	20%	6.0%
Unemployed	-	5.3%	2.0%	2.7%	4.7%	-	3.0%
Total	-	100%	100%	100%	100%	100%	100%

In Paracuri, children are students, but a few of them already said they were unemployed, indicating the intention or need to work. Teenagers are students, self-employed, workers in the private sector, housewives and unemployed; adult life starts during adolescence in Paracuri. Most young adults are workers in the private sector, self-employed and unemployed; most middle aged adults are housewives (grandmothers who live with children's families) and self-employed. Most people over 65 are retired, and have their pensions welcomed in their households. The formal sector accounts for 23.3% of the population's occupation. The informal sector accounts for 25.8%. 29.8% of the surveyed population are students. Housewives and unemployed sum to of Paracuri's 21% (Table 7.25).

Table 7.25. **Age and occupation in Paracuri's population** (89.8% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
Public sector	-	-	-	3.6%	4.8%	-	2.4%
Private sector	-	-	8.7%	**25.0%**	14.3%	-	15.3%
Pro-Self employed	-	-	4.3%	12.5%	14.3%	20.0%	9.7%
Low skilled self employed	-	-	13.0%	19.6%	23.8%	-	15.3%
Daily rate jobs	-	-	-	1.8%	-	-	0.8%
Domestic jobs	-	-	-	5.4%	-	-	2.4%
Student	**100%**	**92.9%**	**56.5%**	8.9%	4.8%	-	**29.8%**
Retired/pens	-	-	-	-	9.5%	**40.0%**	3.2%
Housewife	-	-	4.3%	5.4%	**28.6%**	20.0%	8.9%
Unemployed	-	7.1%	13.0%	17.9%	-	20.0%	12.1%
Total	100%	100%	100%	100%	100%	100%	100%

In Arthur Bernardes, children start school when they are 6 years old; some are classed as unemployed. Most teenagers are students or unemployed, self-employed or domestic workers; young adults do not study; most of them work in the private sector, or are low skilled self-employed and unemployed. This is also the age band with all self-denominated housewives. Middle-aged

[3] Vending activities are on different scales in Tucunduba. In the shallowest areas there are stalls of vegetables and meat; in the more segregated and poorest areas, towards the river, those who can afford to have a fridge sell ice to those who cannot. Many sell charcoal to those who do not have stoves, and the small shops sell small quantities of everything, such as individual biscuits, millilitres of oil and milligrams of sugar.

adults are not retired, they are self-employed and unemployed. 21.2% of workers' occupations are in the formal sector, always in the private sector; self-employment accounts for 24% of the population. 22.5% of inhabitants are students, 24.0% are unemployed, and 8.4% are housewives. Arthur Bernardes people have a more restricted prospect in terms of education and regular access to income. Adult life starts early, and perhaps the lack of older women to help with children at home and the more difficult access to schools, prevents the return of adults to school and reduces the family's long-term prospects (Table 7.26).

Table 7.26. **Age and occupation in Arthur Bernardes' population** (77% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
Public sector	-	-	-	-	-	-	-
Private sector	-	-	-	**30.8%**	-	-	17.0%
Pro-Self employed	-	-	7.7%	5.1%	25%	-	7.0%
Low skilled self employed	-	-	-	23.1%	**37.5%**	-	17.0%
Domestic jobs	-	-	7.7%	2.6%	-	-	2.8%
Student	-	**90.9%**	**46.2%**	-	-	-	22.5%
Retired/pens	-	-	-	2.6%	-	-	1.4%
Housewife	-	-	-	15.4%	-	-	8.4%
Unemployed	-	9.1%	38.5%	20.5%	**37.5%**	-	**24.0%**
Total	-	100%	100%	100%	100%	-	100%

All children are students in Control 2 area. Teenagers are students or unemployed. Young adults are self-employed (mostly low-skilled), unemployed or private sector workers. Most middle-aged adults are low skilled self-employed. Most people over 65 years of age are housewives (grandmothers) or self-employed. 13.5% of occupations are in the formal sector; 28.7% in the informal sector. 41% of the total are students, 16.7% are housewives or unemployed. Control 2 numbers are no better than Paracuri's, confirming less favourable conditions than Control 1's (Table 7.27).

Table 7.27. **Age versus occupation in Control 2's population** (88% of interviewees answered this question)

	Up to 5	6 - 11	12 - 18	19 - 40	41 - 65	+ 65	Total
Public sector	-	-	-	-	8.3%	-	1.5%
Private sector	-	-	-	13.6%	8.3%	-	6.0%
Pro Self employed	-	-	-	13.6%	-	14.3%	6.0%
Low skilled self employed	-	-	-	**27.3%**	**50.0%**	14.3%	19.7%
Domestic jobs	-	-	-	-	-	14.3%	1.5%
Student	**100%**	**100%**	**75.0%**	13.6%	-	-	**41.0%**
Retired/pens	-	-	-	4.5%	16.7%	-	4.5%
Housewife	-	-	-	9.1%	8.3%	**28.6%**	7.6%
Unemployed	-	-	25.0%	18.2%	-	14.3%	9.1%
Landladies	-	-	-	-	8.3%	14.3%	3.0%
Total	100%	100%	100%	100%	100%	100%	100%

Space, through location and configuration, may have enhanced economic prospects of Santa Casa's inhabitants, despite their educational limitations. Besides, present investment in education (if qualitatively reliable) indicates better economic prospects for the future. Santa Casa and Santa Cruz seem to have similar prospects in terms of regular access to income, but the latter has a higher proportion of unemployment and a lower percentage of students than the former.

Tucunduba has the biggest proportion of people without a defined profession; they perform low-skilled jobs on a short term or daily basis, or are street vendors. These workers are highly dependent on the availability of jobs nearby. The proportion of low skilled self-employed may have an influence on the proportion of teenagers assuming family responsibility earlier in life than in the other case study areas in the city centre, at the expense of their school attendance. Early school leaving due to early work is also a problem in the expansion area, since even children are considered unemployed, and therefore available for work. An important difference between the city centre and expansion areas is adult school attendance, favoured when there is easy access to schools and domestic support given by older people.

7.4.1.3. Sub–conclusions to entitlement

Despite the common origin of case study areas as informal settlements, access to education and to income is diverse. Access to fundamental education among children and teenagers has been effective; however continuation of education does not happen in the same proportion over all case study areas. Teenagers in the expansion area are not progressing to intermediate education as they are in the city centre. In Tucunduba case study the situation is less favourable than in Santa Casa and Santa Cruz, but young adults' completion of intermediate education indicates that they are returning to school at some stage of life. Levels of illiteracy and lower levels of education among elders reflect the general situation of elders in the country, according to Berquó (2001) 42% of them are illiterate, and this provides a parameter of the increasing value attached to education among the population.

The cases of higher education among young adults are another indication of easier access to education within the city centre, and of some distinction of Paracuri in relation to the other case study area in the expansion area. Santa Cruz is the only informal area where most of the population is concentrated in the intermediate level of education. Concentration of mature adults on primary and fundamental levels of education over all case study areas also provides a parameter to the diverse achievements of younger adults. Either depth or local integration in each area predicts achievements in education. Control 1 (most integrated according to all syntactic measurements) presents the better prospects, Santa Cruz (intermediate local integration) presents the best prospects and Tucunduba (the deepest area) presents the lowest among the informal areas within

the city centre. In the expansion area, local integration predicts achievements in education, with similar prospects for Paracuri and Control 2 and lower prospects for Arthur Bernardes.

Control 1 offers a reference of access to income for different ages and genders in formal areas. In Santa Casa the situation is different from Control 1, with a higher level of self-employment (professional and unskilled) among adults, and a lower level of stated unemployment (perhaps some were identified as students, what has a positive conotation). This may confirm the potential of delivery by space of advantages for informal activities, which benefit from the streets' potential of accessibility (on sidewalks or in front of houses). In Santa Cruz, most adults are employed and rates of stated unemployment are higher, with less self-employment. This may confirm the lower possibilities of providing opportunities through street accessibility in this area than in Santa Casa.

In Tucunduba case study area, the profile of teenagers' occupation is different from that of the previous areas. Work starts early in life, and the majority of workers do not have professional skills; however, levels of stated unemployment are lower than in Santa Cruz. This might mean that the skills of Tucunduba's inhabitants are 'inappropriate' to the city's employment standards, due to their origin (higher proportion of migrants). Nevertheless, they somehow cope with their spatial limitations, either going to work (usually vending) on streets outside their living space or performing casual jobs.

Rates of stated unemployment are higher in the expansion area than in the city centre, and among workers there is a prevalence of low skilled self-employment. Less than half of teenagers are students in Arthur Bernardes; in Paracuri the situation is only slightly better. This might mean the perpetuation of low skilled jobs. In Arthur Bernardes mature adults are not retired, which means that the household cannot rely on pensions; they are either self-employed or unemployed. Despite Control 2's better conditions, the difference of achievements between the population in the city centre and in the expansion area is clear.

7.4.2. Provision Conditions

7.4.2.1. Access to housing

Most inhabitants of all surveyed areas moved to them from a house, which they had owned. This does not mean that they did not need a house; they have come either from other cities, as for instance in the Tucunduba case study; from split families, as in the Paracuri case study; or from parents' houses, as in the Arthur Bernardes case study. In Santa Casa and in Santa Cruz, some inhabitants came from relatives' houses (classified as borrowed); only in the Arthur Bernardes area can be it assumed that some of the inhabitants have come from an invasion area. In other cases,

people moved from rented houses, presented by interviewees as the main motive for moving to surveyed areas where they could buy a house. However, those who came from houses which they owned seem to be as resistant to rent payment as those who previously rented houses and wanted to be free of it, and willing to trade-off worse environmental conditions for house ownership (Table 7.28). This confirms the importance given to tenure ownership in the literature (section 3.2.1, Chapter 3).

Table 7.28. **Previous housing condition per case study area** (98.3% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Rented house/flat	32.4%	31.7%	34.9%	35.9%	16.7%	16.7%	43.8%	30.4%
Invasion	-	-	-	-	-	4.2%	-	0.4%
Borrowed house/flat	14.7%	12.2%	7.0%	-	10.0%	12.5%	-	8.4%
Own house	**52.9%**	**56.1%**	**58.1%**	**64.1%**	**93.3%**	**66.7%**	**56.3%**	**60.8%**
Total	100%	100%	100%	100%	100%	100%	100%	100%

The type of housing shows how mixed were case study housing circumstances. In Control 1, purchases predominated, with a few cases of inheritance, rent, replacement and exchange. The latter are explained by the negotiations carried out to clear the required land in order to build the official settlement (previous inhabitants of the place received a discount to purchase the new houses or compensation for their houses' demolition). Inhabitants of Santa Cruz said that they bought a plot from informal developers according to a fictitious plan; this was confirmed by technicians who know the area's development. This indicates that portions of land were occupied by clients of informal developers; other portions were occupied by invaders, others by people who bought plots from invaders. The areas used as control areas do not present cases of invasion, and only Arthur Bernardes showed invasion as main type of gaining access (4.9%), probably due to its recent creation (Table 7.29).

This evidence confirms that informal settlements are far from completely informal (section 3.2.1, Chapter 3); invasions are not characterised by isolated actions. There is always a certain level of organisation, translated into plot value charged to those who buy the plots later. This indicates the importance of social solidarity in gaining information about land or plot availability.

Table 7.29. **Type of housing access per case study area** (97.8% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Purchase	**82.4%**	**82.9%**	**76.7%**	**76.9%**	**73.5%**	41.7%	18.2%	**71.7%**
Invasion	11.8%	4.9%	14.0%	-	8.8%	**45.8%**	-	11.5%
Exchange	5.9%	-	2.3%	5.1%	8.8%	4.2%	9.1%	4.4%
Replacement	-	2.4%	-	2.6%	8.8%	-	**63.6%**	5.3%
Rent	-	7.3%	2.3%	5.1%	-	4.2%	9.1%	3.5%
Inheritance	-	-	-	10.3%	-	-	-	1.8%
Donation	-	4.7%	4.7%	-	-	4.2%	-	1.8%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Obtaining housing is connected with the condition of land provided, and its physical and social infrastructure. Therefore the location's potential for land uses and extension for infrastructure have differentiated inhabitants' housing conditions. Public health concerns offer an example of this. All case study areas have disadvantaged conditions related to public health, with presence of mud and stagnant water, inefficient waste collection, and presence of pit latrines. In all areas, interviewees complain about mosquitoes and the diseases they transmit; in Tucunduba and Santa Cruz the pests are said to be everywhere, especially rats, and cases of diarrhoea are increasing as are the levels of water and soil pollution. In Santa Cruz, worms have always been a problem for children. In Paracuri, this perception of pollution is less intense; they say that when the waste collection fails they burn the rubbish, and that the water is good to drink, even though they know that wells are covered by floods during the rainy season (fieldwork, 2000).

Inhabitants evaluate health support according to the provision of health care. The best situation is to live close to good hospitals, where treatment and medicines are provided for inhabitants. From this perspective, inhabitants of Tucunduba and Santa Casa case study area are privileged by their proximity to two university hospitals. Tucunduba is very close to the general hospital and Santa Casa to the hospital specialising in tropical diseases; both are well regarded for the service they provide for the community. Beside the federal hospitals there are health centres maintained by the state and city governments, although the quality of the service provided is always questioned by inhabitants, who complain about their physical incapacity to assist patients, and the professional negligence of health personnel. In the expansion area, people say that the health centre is useless. However, it is the only health facility available in the area (fieldwork, 2000).

From the inhabitants' perspective, the shortcomings of the existing environment create over-pressure on health care facilities which it is not possible to measure within the scope of this research. However, it is possible to observe that, from users' perspectives, there are different responses to the social infrastructure in the city and in the expansion area, dependent upon who their neighbours are.

Box 7.1. Inhabitants' opinions about transport conditions

When telling their history, interviewed inhabitants considered that the transport service has improved in Tucunduba basin over time, mainly after the ending of the transport service monopoly of one bus company, and installation of the university bus terminal. To take an ill person or a pregnant woman to the hospital was a tough task in the past; now taxis can go much further, motorcycles can go everywhere, and bus routes are available for many districts of the city. Only the surroundings of the river banks in the innermost area are up to 500 m from any bus route. The average distance from inner areas to bus stops was 1 km before upgrading. Inhabitants said that at that time, their advantage was to be able to reach other districts on foot, no matter how

long the journey took them. However, the upgrading achievements are not always reliable; the pavement of the canal's lateral roads in Santa Cruz was destroyed after the first rainy season, and the new bus route created to run on them was suspended for many months.

In Paracuri the shops are small, and inhabitants can reach Icoaraci shops, the market and open market by bicycle, although, depending on what they want to buy, they may prefer to take a bus to look for better prices in the city centre. They mentioned the existence of a system of credit in local shops and with street vendors. The bus service was provided within Paracuri five years ago, and they have now two alternative routes; bus stops are now closer to inhabitants, but buses are not yet as frequent as desired. Access to vehicles is prevented by the mud, and during the rainy season the water level rises by up to one metre and floods streets, houses and wells. The river water is contaminated but, as happens in Tucunduba, some inhabitants seem not to bother themselves about it. In Arthur Bernardes the small shops located along the road are close to the two bus stops located in it. For inhabitants who are not happy with the local shops, the alternatives are either to walk or to go by bicycle to Icoaraci, or to take a bus to the city centre (the trip takes 45 min).

7.4.2.2. The street

Observation of the period of settlement in the present household (Fig. 6.10), shows that the Control 1 area was probably occupied before the city centre case study areas. The most usual period of settlement among surveyed households was the 1970's in the city centre, the late 1980's in the Paracuri case study area and the 1990's in Arthur Bernardes and Control 2. Santa Cruz and Arthur Bernardes, the densest informal areas, and Controls 1 and 2, the formal areas, contained more than 50% of original inhabitants among their surveyed households than the other case studies (Table 7.30). This may indicate low levels of gentrification in these areas, but also among its first inhabitants a strong desire to stay. In interviews, Santa Cruz's inhabitants, said that the place is now a paradise compared to how it was before (they were talking about physical conditions). In the Paracuri case study, nearly 60% of surveyed households were not the first to occupy the plot. This may be a consequence of the irregular pattern of occupation, or due to some gentrification after upgrade actions (Fig. 7.6 and Table 7.31).

7.30. **Period of settlement by the present household per case study area** (98.3% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
After 1998	8.8%	7.3%	9.3%	-	8.8%	**50.0%**	25%	12.3%
1994 – 1997	-	12.2%	7.0%	5.1%	14.7%	41.7%	**50%**	13.7%
1990 – 1993	14.7%	17.1%	11.6%	2.6%	20.6%	4.2%	25%	12.8%
1986 – 1989	17.6%	12.2%	16.3%	2.6%	**23.5%**	-	-	11.9%
1982 – 1985	11.8%	17.1%	16.3%	23.1%	8.8%	-	-	13.2%
1970 – 1981	**32.4%**	**24.4%**	**34.9%**	**33.3%**	14.7%	4.2%	-	**24.2%**
Prior to 1970	14.7%	9.8%	4.7%	**33.3%**	8.8%	-	-	11.9%
Total	100%	100%	100%	100%	100%	100%	100%	100%

FIG. 7.6: MAP OF PREVIOUS PLOT OCCUPATION

Source: CELPA, 1998; CODEM, 1998

Table 7.31. **Previous plot occupation per case study area** (96.1% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Yes	**44.1%**	34.1%	**43.9%**	31.6%	**58.8%**	36.4%	25%	40.5%
No	26.5%	**56.1%**	34.1%	**50.0%**	29.4%	**50.0%**	**66.7%**	**42.3%**
Unknown	29.4%	9.8%	22.0%	18.4%	11.8%	13.6%	8.3%	17.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%

In all surveyed areas there was a strong perception of street change (Table 7.31 and Fig.7.7). In Control 1 the most frequently perceived changes were street pavementing and house refurbishment. In the city centre case studies, landfill and drainage were mentioned as the main changes. Santa Casa's inhabitants had the lowest perception of street change (63%) and Santa Cruz's and Tucunduba's had the highest (93%); this may be due to the high level of transformation of the original site conditions in these areas. Only in Santa Cruz was the perception of change more diverse, with house refurbishment coming close as the second most frequently perceived change (Table 7.32).

Table 7.32 **Perception of street change per case study area** (97.8% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Yes	**61.8%**	**92.7%**	**92.9%**	**87.2%**	**76.7%**	**70.8%**	**87.2%**	**82.3%**
No	38.2%	7.3%	7.1%	12.8%	23.3%	29.2%	12.5%	17.7%
Total	100%	100%	100%	100%	100%	100%	100%	100%

In Control 2 the most perceived change was of pavementing, in Paracuri it was house refurbishment, followed by landfill and drainage. This is associated with the fact that 60% of surveyed households were not occupied by original inhabitants, which reinforces the hypothesis of some gentrification. In Arthur Bernardes better drainage and landfill were mentioned as frequently as water, electricity and public transport provision. The promotion of change was mostly attributed to the government in Controls 1 and 2, to inhabitants in Santa Casa, to government and inhabitants in Santa Cruz, to inhabitants and government in Tucunduba, to inhabitants and politicians in Paracuri, and to inhabitants and government in Arthur Bernardes (Table 7.33).

Table 7.33 **Type of street change per case study area** (number of responses – more than one answer per respondent was allowed) (97.4% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
Change	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Drainage and landfill	**15**	**36**	**24**	9	14	**10**	5	**113**
Pavement	4	19	10	**27**	-	1	**13**	74
Water, electricity and public transport provision	9	25	11	7	10	**10**	10	82
Houses refurbishment	9	32	12	22	**18**	5	9	107
New uses	3	16	10	11	13	6	9	68
Deterioration	1	7	4	-	2	1	1	16
Total	41	135	71	76	57	33	47	460

FIG. 7.7: MAP OF PERCEIVED STREET CHANGE
Source: CELPA, 1998; CODEM, 1998

The answers given, show that inhabitants have always taken part in street improvement within surveyed informal areas (Table 7.34); interviews have shown that local contributions were the most common way of starting landfill, always followed by deals with politicians to provide water and electricity, and concluded by government upgrade actions. This means that the number of inhabitants, and their access to income, is important to a settlement's rhythm of consolidation. The denser the settlement and/or the more stable the inhabitants' income, the easier it was to raise the money to improve environmental conditions.

Table 7.34. **Promoters of change per case study area** (number of responses - more than one response per question was allowed) (77.1% of interviewees answered this question,)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Inhabitants	**14**	18	**23**	5	**9**	**8**	3	80
Associations	-	4	1	-	2	1	-	8
Politicians	7	10	8	1	8	2	2	38
Government	8	**23**	18	**25**	4	6	**8**	**92**
Private Company	-	-	-	-	-	3	-	3
Total	29	55	50	31	23	20	13	-

Possible contributions to Santa Casa's improvements are the time it has had to consolidate, and the more stable economic condition of its inhabitants, although this has also pushed the process backwards, since Santa Casa's inhabitants, who have built their houses with bricks and mortar, do not want big upgrade works. They fear that changes in street alignments would imply demolition of part of their houses. In Santa Cruz, higher densities (78 dw/ha, see table 6.30 in Chapter 6) might have allowed more contributions and more votes to bargain with politicians. House material conditions in Santa Cruz and Tucunduba (most houses are made of wood) have facilitated the creation of setbacks of houses facing an upgraded street in Santa Cruz, and the programmed displacement of houses facing the river in Tucunduba (upgrade of the river Tucunduba's banks is in progress, see Chapter 8). In the expansion area, Paracuri was an exceptional case (Paracuri was selected to conduct a pilot study of upgrade in the expansion area, see Chapter 8). In Arthur Bernardes, density (75.5 dw/ha and 56 dw/ha) has been important in bargaining to achieve street landfill, although the settlement's scale and isolation may limit the power of density effects in attracting extension of social and physical infrastructure.

Fig 7.8. A consolidated street in Tucunduba basin: landfill, house refurbishment, new uses and provision of water, power and telephone.

Another important consideration about changes is their qualitative aspect. The occurrence of changes has not guaranteed achievement of desirable physical infrastructure standards. The quality of pavement is not always reliable; it may deteriorate after a few rainy months; there is still shortage of water and lack of sanitation, which encourage contamination. There are complaints from inhabitants, who live in streets lower than those upgraded, about drainage works (see Chapter 8); they say that their streets have got worse after the neighbours' upgrade. Problems caused by water damming up occur on several scales: between plots, streets and whole districts. Within Tucunduba basin, the drainage of the river source was done prior to that of the main river mouth, and for this reason levels in the source are lower than they should be to avoid floods permanently. This means the delivery of a 'second class' environment to inhabitants of upgraded areas, permanently threatened by floods during local rainy seasons. Floods also happen in the expansion area, in the Paracuri settlement, but these are due to insufficient drainage (fieldwork, 2000).

There might have been a moment in the consolidation process when it was easier to promote changes in configuration; when inhabitants' investment in their houses is larger, transformation is less welcome (Fig. 7.8 and 7.9). The incremental nature of transformation left behind spatial marks that prevent complete consolidation of upgraded areas into the formal city, since upgraded spaces may still be vulnerable to problems caused by poor infrastructure solutions.

Box 7.2. Inhabitants' descriptions of settlements' original conditions

- Santa Casa and Santa Cruz - a flooded area where houses were built over water (on plots of 5m x 20/25 m). The water was inhabited by snakes, fish and eels; people walked on raised wooden walkways made with trunks of palm trees which inhabitants used to maintain (and from which children also used to fall). There was neither piped water nor electricity, but people felt safe from violence.
- Tucunduba – a place with flooded plots (7m x 30 m), few houses and a beautiful river (the other bank was covered with vegetation). Access was by raised wooden walkways, as in Santa Cruz. Too much mud in landfilled streets.

- Paracuri - there were just rooms of wood covered with canvas. For those who bought a plot in an illegal settlement, also established in the area, the place was dangerous. They had to pay tolls to drug addicts to get into the area until 1992. Houses were built of wood with external pit latrines. The place was attractive, close to nature, with an atmosphere apparently peaceful and calm.
- Arthur Bernardes – this was an abandoned place. Each person had to clean his/her plot of mud and grass before occupying it; some plots were flooded. The plots were 8m x 14m and 7m x 14 m, and houses had one room, covered with canvas.

Fig 7.9 – Occupation along Arthur Bernardes Road in 1998 (left) and 2000 (right).

7.4.2.3. The plot

In Santa Casa and Santa Cruz case study areas around 50% of respondents have modified their plot, in most cases by landfill, compared with 25% of plot adaptation in the Tucunduba case study and 15% in Control 1. In the expansion area, 41% of plots among surveyed cases in Paracuri case study, and 21% in Arthur Bernardes were adapted, compared with 15% in Control 2. Controls have shown a degree of plot adaptation even in formal and dry areas, but always much less than in informal settlements, where the sites' natural conditions had to be modified to suit occupation (Table 7.35 and Fig. 7.10).

Numbers of house adaptations are higher than of plots: 66% in Santa Casa, 83% in Santa Cruz, 67% in Tucunduba, 76% in Control 1, 84% in Paracuri, 54% in Arthur Bernardes and 63% in Control 2 (Fig. 7.11). This indicates that most inhabitants slowly improve or enlarge houses, following an increase of income or household needs (e.g.: a marriage, a birth, when donations are accepted, or available money may be transferred from other basic needs to shelter, even if meaning less food). Santa Cruz and Paracuri have shown higher levels of house adaptation, due to household needs and change in income respectively. In another city centre case study, house adaptation is usually explained by change of income; within the expansion area change of income is closely followed by household needs as a cause of enlargement (Tables 7.36 and 7.37).

FIG. 7.10: MAP OF PLOT ADAPTATION

Source: CELPA, 1998; CODEM, 1998

FIG. 7.11: MAP OF HOUSE ADAPTATION

Source: CELPA, 1998; CODEM, 1998

Table 7.35. **Plot adaptation per case study area** (91.8% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Yes	46.9%	**53.8%**	25.6%	15.2%	41.1%	20.8%	13.3%	32.5%
No	**53.1%**	47.2%	**74.4%**	**84.8%**	**58.6%**	**79.2%**	**86.7%**	**67.5%**
Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 7.36. **House adaptation per case study area** (97.0 % of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Yes	**66.7%**	**82.9%**	**67.4%**	**76.3%**	**82.8%**	**54.2%**	**62.5%**	**71.9%**
No	33.3%	17.1%	32.6%	23.7%	17.2%	45.8%	37.5%	28.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 7.37. **Time of refurbishment per case study area** (62.3% of interviewees answered this question – number of responses, multiple responses were allowed)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Purchase	6	7	8	3	8	4	2	38
Change in income	**9**	7	**14**	**13**	**10**	**5**	2	**60**
Tenure regularisation	-	-	3	2	1	-	1	7
Street landfill and drainage	-	4	1	-	1	-	-	6
Plot landfill	4	3	1	-	3	1	-	12
Others	2	**16**	5	8	6	**5**	**5**	47
Total	21	37	32	26	29	15	10	-

In Santa Casa only 10% of surveyed workers said they worked at home; the equivalent proportion in Santa Cruz is 14%, in Tucunduba 13%, and in Control 1 24%. There are more self-employed working at home in the middle class environment. The proportion of workers in surveyed households who work at home is much higher in the expansion area; it is 32% in Paracuri, 27% in Arthur Bernardes, and 52% in Control 2. This follows the areas' self-employment tendency, previously described, wherein the self-employed are shopkeepers and workers in workshops located in front of the house. It shows that the plot/house is a more important asset in helping income generation in the expansion area than in the city centre, and also indicates that in the middle of the poorest households, there is a noticeable segment who undertake commercial activities orientated to local supply. This segment is slightly wealthier than the average.

Average plot width ranges from 5m up to 7 m, and plot length ranges from 15m up to 30 m. The most common enlargement identified in all surveyed case studies was a back addition to the existing house, usually to provide more rooms (to the household or to renters). The second most common adaptation was an addition in front of the house (usually the space for a shop), and the third was a second storey; both these are more frequent in Santa Cruz and Tucunduba than in other case study areas. The fourth most common addition was an independent house on the same plot, more common in Santa Cruz and Paracuri. The rarest adaptation was lateral addition, since houses usually occupy the whole plot width when they are built (Table 7.39 – 7.40).

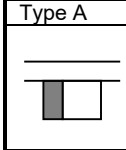
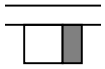
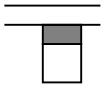
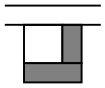
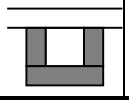
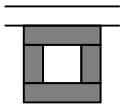
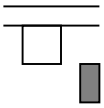
Table 7.38. **Type of adaptation per case study area** (62.8% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Building/ enlargement	94.7%	86.2%	89.7%	91.7%	86.4%	53.8%	100%	86.9%
Change of material	5.3%	13.8%	8.3%	8.3%	13.6%	46.2%	-	13.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 7.39. **Type of enlargement per case study area** (number of responses) (60.2% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Type A	-	-	-	-	1	-	1	2
Type B	**9**	**11**	**10**	**9**	**8**	**7**	**6**	**60**
Type C	1	1	-	1	-	-	-	3
Type D	1	8	7	1	4	1	3	25
Type E	1	-	1	1	2	-	-	5
Type F	2	4	2	1	1	-	1	11
Type G	1	-	2	-	2	-	-	5
Type H	1	7	6	4	1	3	-	22
Type I	4	5	2	2	4	2	1	18
Type J	1	1	1	1	-	-	-	4
Type K	-	-	-	-	-	-	-	-
Type L	-	-	2	-		-	-	2
Total	21	37	31	20	23	13	12	-

Table 7.40 – **Types of house enlargement** (all types in plan form, except type H, which is in section). Additions are colored in gray.

Type A	Type B	Type C	Type D	Type E	Type F	Type G	Type H	Type I
								

The use of the house as an asset to improve income occurs in the city centre and in the expansion area. The most common situation is where the plot is shared by house and shop or workshop; when the commercial activity is small, it takes place in the house or in front of it on a stall, as do some services offered by inhabitants. The bigger shops are located in the settlements' subcentres, along the most integrated roads, while commercial activities decrease in scale as accessibility decreases. If depth (space syntax measurement) predicts the quality of infrastructure, this indicates the contribution of street conditions to enhancing access to income.

7.4.2.4. Sub–conclusion to provision

Responses to inquiries about previous housing conditions show the prevalent willingness of inhabitants to trade-off house ownership against environmental conditions. All efforts are made to avoid compromising their finances by rent payment, independently of the type of previous housing. Purchase was the most common form of access to housing among present inhabitants. Declared

invasions within the city centre informal settlements were less frequent in Santa Cruz, where plots were initially sold by informal developers. The Controls were confirmed as formal areas not presenting any case of invasion, but confirming the distinction between formal and informal areas; Control 1 as a chosen place to live by inhabitants and Control 2 as a place to receive replaced inhabitants from previously informal areas. The highest proportion of invasions were found to be in the newest area, Arthur Bernardes.

The informal settlements surveyed have mixed origins, and inhabitants have shown they are aware of how to incorporate value into their plots and houses, following the same rules as the formal land market. All informal settlements have some degree of disadvantage regarding public health, due to lack of drainage, sanitation and waste collection; all problems caused by insufficient or absent infrastructure. As a form of compensation, land uses in a settlement's vicinity are considered very important to inhabitants. This is clearly observed in inhabitants' concern about easy access to hospitals, emphasising the importance of health care to compensate for their vulnerability to diseases generated by their environmental conditions.

Access to surrounding areas on foot was an advantage of living in the city centre case study areas, as access by bicycle was an advantage in the expansion area. In the city centre, street upgrade has improved accessibility for the most mobility-disadvantaged groups, such as ill people, the disabled and pregnant women.

Responses about period of settlement in the present household showed occupation in the city centre as more intense during the 1970s, in Paracuri during the late 1980s and in Arthur Bernardes and Control 2 during the 1990s. Santa Cruz and Arthur Bernardes (the densest informal areas) and the Controls still had more than half of surveyed population consisting of original inhabitants, whereas more than 60% of the surveyed population is of newcomers in Paracuri case study area, showing the process of gentrification in that area after the upgrade action.

Inhabitant perception of provision is not very diverse from settlement to settlement. Everywhere there is a strong perception of street change. However, changes were said to be less intense in Santa Casa than in other case study areas, and stronger in Santa Cruz and Tucunduba. Changes are usually related to drainage and landfill in all the areas, followed by a high occurrence of house refurbishment in Santa Cruz and of infrastructure provision in Arthur Bernardes. Paracuri is the only area where the most frequent alternative to change in the street was perception of house refurbishment. Inhabitants always see themselves as active agents in a site's initial physical transformations and either the government or politicians as agents of infrastructure provision. Santa Casa's inhabitants felt that they themselves have provided most changes, which is an indicator that

they have been more self-reliant than the other case study area inhabitants. Responses also indicate that interventions should happen during the early stages of consolidation in order to make changes in alignment feasible and qualitatively superior to what has been offered as upgrade in the case study areas.

Inhabitants slowly improve plots (half of them in Santa Casa and Santa Cruz, 1/4 in Tucunduba, 41% in Paracuri, 21% in Arthur Bernardes against 15% in both Control areas) and houses according to money availability. At least 60% of all surveyed households have adapted their house. These levels reach 83% and 84% in Santa Cruz and Paracuri; the former was explained by change in household needs and the latter by change in income. House adaptation is also seen as an investment, since in 40.5 % of surveyed houses, present inhabitants are not the first. Gentrification happens in segregated and integrated streets, but seems to be more intense in previously upgraded areas (see Fig 7.11 and 7.12).

Fig 7.12. Streets in Paracuri basin Left: street in Paracuri case study area. Right: street in the official settlements part of Control 1. The main difference is the presence of pavement in the official settlement.

The perception of housing provision as an asset is stronger in the expansion area, where the house provides a place for the main household activities for income generation (32% in Paracuri, 27% in Arthur Bernardes, 52% in Control 2 against 10% in Santa Casa, 14% in Santa Cruz, 13% in Tucunduba and 24% in Control 1). This is often done by the better-off, those who own a shop or have a workshop and are living amidst the poor. In the city centre also, similar cases of shops and workshops for income generation based at the home are spread all over the area on a smaller scale, and perceived more as complementary to other income sources; in both cases configuration plays an important role, through creating street accessibility and a relationship between the house and public space.

These perceptions are strengthened by the type of enlargements made to the houses. The most frequent change is a back addition to provide more rooms (either for the household or to rent), followed by additions in front of the house, usually to provide space for a shop. A second storey and

the building of an independent house close to the original one are the other usual additions. These provide more flexibility but require more investment. The amount of investment in streets and housing should be understood as critical to the contribution of provision to inhabitants' life chances. Configuration, through depth, seems to play an important role in this, defining the potential for exploitation of the house as an asset, ranging from its providing freedom from rent, in a segregated street close to well-served areas, to it enabling the establishment of home-based income generation, where occupants benefit from better accessibility.

7.4.3. Ligatures

7.4.3.1.Trade-offs

When inhabitants were questioned about their motivations in choosing their plot, most of them in all surveyed areas, except in Control 1 and Paracuri, said they did not choose them because of physical conditions. Only in Control 2 was plot location not considered important; most Arthur Bernardes inhabitants considered location very important; most Santa Casa and Santa Cruz inhabitants considered location important, and in the other areas most answers were distributed between very important and important. Price was very important to the majority of inhabitants in Tucunduba, Paracuri and Arthur Bernardes. In Santa Cruz, most answers to the question about price were divided between very important and important. The possibility of enlargement or subdivision was not considered important in Santa Cruz and Tucunduba, while it was considered very important in Paracuri and Arthur Bernardes (Table 7.41).

Table 7.41 **Motivations for plot selection per case study area**

Attractions and percentages of responses	Degree of importance	Tucunduba basin – city centre				Paracuri basin – expansion area			Total
		Santa Casa	Santa Cruz	Tucun duba	Control 1	Paracuri	Arthur Bernardes	Control 2	
Physical condition 61.9%	Very important	4.5%	2.4%	6.7%	21.1%	27.3%	14.3%	40.0%	13.3%
	Important	9.1%	12.2%	6.7%	36.8%	**36.4%**	7.1%	10.0%	17.5%
	Not considered	**86.4%**	**85.4%**	**86.7%**	**42.1%**	**36.4%**	**78.6%**	**50.0%**	**69.2%**
	Total	100%	100%	100%	100%	100%	100%	100%	100%
Location 68.0%	Very important	18.2%	29.3%	**41.7%**	**42.1%**	**41.7%**	**56.3%**	9.1%	34.4%
	Important	**50.0%**	**53.7%**	37.5%	**42.1%**	37.5%	18.8%	18.2%	**40.8%**
	Not considered	31.8%	17.1%	20.8%	15.8%	20.8%	25.0%	**72.7%**	24.8%
	Total	100%	100%	100%	100%	100%	100%	100%	100%
Price/cost 68.4%	Very important	28.0%	**43.9%**	**52.0%**	25.0%	**54.5%**	**64.7%**	**50.0%**	**44.3%**
	Important	**40.0%**	41.5%	24.0%	**40.0%**	31.8%	23.5%	12.5%	33.5%
	Not considered	32.0%	14.6%	24.0%	35.0%	13.6%	11.8%	37.5%	22.2%
	Total	100%	100%	100%	100%	100%	100%	100%	100%
Possibility of enlargement or division 60.2%	Very important	13.6%	14.6%	21.4%	**38.9%**	20.0%	**60.0%**	33.3%	25.2%
	Important	40.9%	29.3%	28.6%	33.3%	**50.0%**	13.3%	33.3%	33.1%
	Not considered	45.5%	**56.1%**	**50.0%**	27.8%	30.0%	26.7%	33.3%	**41.7%**
	Total	100%	100%	100%	100%	100%	100%	100%	100%
Other 6.5%	Very important	100%	-	100%	-	-	100%	66.7%	**66.7%**
	Important	-	-	-	100%	100%	-	33.3%	33.3%
	Total	100%	-	100%	100%	100%	100%	100%	100%

When questions were asked about motivations in choosing the house, the majority of inhabitants in Santa Cruz, Tucunduba and Arthur Bernardes said that physical conditions were not taken into account. Location was considered important to most inhabitants in Santa Cruz, Tucunduba and Paracuri, and very important in Arthur Bernardes. Price was considered either important or very important to most inhabitants in all surveyed areas. The possibility of enlargement or division was not considered by the majority in the city centre areas; in the expansion area, it had more importance (Table 7.42).

Table 7.42 **Motivations for house selection per case study area**

Attractions and percentages of responses	Degree of importance	Tucunduba basin - city centre				Paracuri basin – expansion area			total
		Santa Casa	Santa Cruz	Tucun duba	Control 1	Paracuri	Athur Bernardes	Control 2	
Physical condition 59.3%	Very important	4.5%	19.4%	17.6%	**40.9%**	27.8%	30.8%	33.3%	23.4%
	Important	45.5%	30.6%	29.4%	27.3%	**44.4%**	23.1%	**66.7%**	35.8%
	Not considered	**50.0%**	**50.0%**	**52.9%**	31.8%	27.8%	**46.2%**	-	**40.9%**
	Total	100%	100%	100%	100%	100%	100%	100%	100%
Location 60.2%	Very important	28.6%	25.7%	21.1%	**45.0%**	34.8%	**46.2%**	37.5%	32.4%
	Important	**42.9%**	**42.9%**	**57.9%**	35.0%	**60.9%**	23.1%	**50.0%**	**45.3%**
	Not considered	28.6%	31.4%	21.1%	20.0%	4.3%	30.8%	12.5%	22.3%
	Total	100%	100%	100%	100%	100%	100%	100%	100%
Price/cost 61.0%	Very important	30.4%	27.3%	**45.0%**	20.0%	**41.2%**	**41.2%**	**37.5%**	33.3%
	Important	**52.2%**	**42.2%**	20.0%	**52.0%**	35.3%	35.3%	25.0%	**39.7%**
	Not considered	17.4%	30.3%	35.0%	28.0%	23.5%	23.5%	**37.5%**	27.0%
	Total	100%	100%	100%	100%	100%	100%	100%	100%
Possibility of enlargement or division 57.1%	Very important	13.6%	12.5%	22.2%	-	**45.0%**	27.3%	25.0%	18.9%
	Important	31.8%	21.9%	27.8%	23.8%	25.0%	27.3%	**62.5%**	28.0%
	Not considered	**54.5%**	**65.6%**	**50.0%**	**76.2%**	30.0%	**45.5%**	12.5%	**53.0%**
	Total	100%	100%	100%	100%	100%	100%	100%	100%
Other 3.0%	Very important	-	-	100%	-	25.0%	-		28.6%
	Important	-	-	-	100%	**75.0%**	-	100%	**71.4%**
	Total	-	-	100%	100%	100%	-	100%	100%

These answers demonstrate the trade-off city centre inhabitants make when they accept worse physical conditions and less flexibility in house and plot size for the sake of lower price and more favourable location. Actually, previous data shows that the trade-off is between worse physical condition and a better price and location, since the increase of density occurs independently of inhabitants' original motivations. When they need more space, they subdivide even a tiny plot or house, but continue living in the best location they can afford (fieldwork, 2000).

In the expansion area, the importance of price and location is affected by the need for more flexible plots/houses and other motivations, especially in Paracuri. The importance given to location may be clarified through noting inhabitants' opinions about accessibility. Within the city centre, inhabitants of all case study areas considered their living place accessibility conditions good and very good; only in Tucunduba were their opinions divided between very good, good and more or less good. It is important to notice that inhabitants made clear references to what they considered well-located within the city and the district. In the expansion area, inhabitants were less assertive. Arthur Bernardes' inhabitants showed a more positive evaluation of the accessibility provided, and clear

references to what they consider good accessibility within the city and the district. Control 2 inhabitants were more negative about their accessibility. Paracuri's inhabitants had divided opinions and were the most confused in terms of their estimation of good accessibility (Table 7.43).

Table 7. 43 **Perceived accessibility in the area and accessibility references** (households per case study area)

Perceived accessibility 97.4% of responses		City Centre				Expansion area			Total
		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	
Very good		20.6%	34.1%	**37.2%**	46.2%	10.3%	21.7%	12.5%	28.9%
Good		**47.1%**	**56.1%**	25.6%	**48.7%**	**31.0%**	**34.8%**	25.0%	40.0%
More or less		20.6%	7.3%	27.9%	5.1%	24.1%	21.7%	18.8%	17.3%
Bad		8.8%	2.4%	2.3%	-	3.4%	4.3%	-	3.1%
Very bad		2.9%	-	7.0%	-	**31.0%**	17.4%	**43.8%**	10.7%
Total		100%	100%	100%	100%	100%	100%	100%	100%
Knowledge about accessibility – city 87.0% of responses	Yes	**100%**	**100%**	**97.4%**	**97.3%**	57.1%	**92.9%**	**64.3%**	90.0%
	No	-	-	2.6%	2.7%	42.9%	7.1%	35.7%	10.0%
Knowledge about accessibility – district 77.0% responses	Yes	**96.4%**	**88.9%**	**83.3%**	**96.8%**	50.0%	**83.3%**	**64.3%**	82.1%
	No	3.6%	11.1%	16.7%	3.2%	50.0%	16.7%	35.7%	17.9%

Location is more important to Arthur Bernardes' inhabitants than to Paracuri's; in the former the same trade-off between physical condition and location as in the city centre exists. Moreover, in Arthur Bernardes, occupation through invasion has allowed more attention to plot/house flexibility for future enlargement and subdivision. In Paracuri, price was very important, physical conditions and possibility of plot/house enlargement and subdivision were more important than in other case study areas, and perhaps at the expense of location. Paracuri is the exception; perhaps due to better environmental conditions than in other case study areas, new inhabitants were not led only by poverty when they chose this place in which to live.

7.4.3.2. Motivations and values

In interviews, inhabitants said that their motivation to join an invasion was primarily economic, even for those who did not intend to stay on newly occupied land (to whom the plot has an exchange value). Joining an invasion is always a strategy to overcome financial limitations. Inhabitants who live in the city centre said that friends and relatives informed them about the invasion or the existence of plots for sale. Once informed that there would be an invasion, they joined it, whatever motivations the invasion leader had. In cases where they had missed the invasion moment, their alternative was to purchase an invaded plot, if they could afford one, respecting the 'rights' of the original invaders.

Inhabitants of the expansion area said that the invasions are now organised from a registration list (when money equivalent to £ 5.00 is paid). The organiser establishes the number of registrations available to each invasion; when the number is completed, the registration is over. The number of registrations available depends on the size of the chosen site and of planned plots. Interviewees said that most people want to make a profit by selling the plot afterwards (fieldwork, 2000).

When a house's use value is more important than its re-sale, the achievement of house ownership means a first step on a ladder to overcome poverty, confirming the literature (Turner, 1976; Souza, 1998). It means freedom from rent, and more money available for food and school demands, and in a long term prospect, the possibility of house improvement over time. Depending on the location, it also means easier access from house to school, health care and sources of jobs and income. It seems that location has a local connotation for households, since inhabitants of both basins consider themselves well located, although the trade-offs between house ownership, location, price and physical conditions are not weighted equally for all. Interviews had shown that the initially poorest considered the environmental difficulties worth facing, but those who came from an owned house looking for a peaceful place to live close to nature, were unhappy with the slow process of upgrade and had more complaints (Table 7.44) (fieldwork, 2000).

Table 7.44 **Intention of moving house** (98.3% of interviewees answered this question)

	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Intended to move	**58.8%**	31.7%	48.8%	17.9%	**53.3%**	**50.0%**	43.8%	42.3%
Do not intend to move	41.2%	**68.3%**	**51.2%**	**82.1%**	46.7%	**50.0%**	**56.3%**	**57.7%**

Thanks to location, some inhabitants earn money as street vendors, shopkeepers, servants, self–employed skilled craftsmen (plasterers, plumbers, carpenters, bricklayers) or room landlords. They do not want to move after the struggles and achievements they have made, but they want a better place for their children. The plot is a family property where children may build their houses in a row behind the original house, or extend the latter according to family growth. Those who cannot afford to stay sell their house and move to a newer invasion or to the countryside; this happens when jobs are scarce. In Santa Casa, many inhabitants have refused tenure regularisation, thinking that to accept it would imply an obligation to pay taxes; however, tax payment is an obligation on every household in the city served by infrastructure, except for those whose house value is lower than 94MW (see chapter 8), independent of land ownership (fieldwork, 2000).

In the Paracuri case study, public safety has improved during the last five years, because the area has become physically and socially better connected and less favourable to criminal action. In Arthur Bernardes, inhabitants said that safety conditions have improved after the invasions were established, but visitors still fear to move around, because there is strong inhabitant control of the

space along physically unpredictable streets. Conversely, according to interviewees, safety conditions have deteriorated within the city centre, because of the increasing mobility of inhabitants. The oldest inhabitants complain about this, saying that it is a side-effect of upgrade. The violence is critical in the Tucunduba area, where during the night robbery and assaults are common and there are even murders; some streets are under the control of addicts and drug-dealers. In Santa Cruz, inhabitants say that clashes between neighbours who are drunk or have divergent points of view are the most common disturbance. However, in a few narrow streets, inhabitants are very suspicious in a way in which intimidates visitors, to show that they are in control (fieldwork, 2000).

When questioned about safety in their living place, inhabitants have confirmed the tendencies noticeable in interviews. Santa Cruz, Control 1, Paracuri and Arthur Bernardes have a more positive evaluation of safety than Santa Casa, Tucunduba and Control 2, which have a more negative evaluation. When questioned about references to safe places within the city and their districts, many inhabitants demonstrated their skepticism about safety anywhere in the city (Table 7.45).

Table 7.45 **Perceived safety in the area and safety references** (household per case study)

Perceived safety 97.0% of responses		City centre				Expansion area			
		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Very good		11.8%	9.8%	16.7%	23.1%	17.2%	8.7%	12.5%	14.7%
Good		14.7%	**48.8%**	9.5%	**35.9%**	27.6%	**34.8%**	6.3%	26.8%
More or less		**35.3%**	26.8%	**31.0%**	28.2%	**31.0%**	30.4%	**43.8%**	**31.3%**
Bad		11.8%	7.3%	21.4%	10.3%	10.3%	8.7%	12.5%	12.1%
Very bad		26.5%	7.3%	21.4%	2.6%	13.8%	17.4%	25.0%	15.2%
Total		100%	100%	100%	100%	100%	100%	100%	100%
Knowledge about safety – city 76.2%	Yes	46.2%	44.8%	52.8%	45.7%	10.7%	71.4%	26.7%	40.9%
	No	53.8%	55.2%	47.2%	54.3%	89.3%	28.6%	73.3%	56.1%
Knowledge about safety – district 77.9%	Yes	69.2%	63.9%	63.6%	54.5%	42.9%	100%	46.7%	60.0%
	No	30.8%	36.1%	36.4%	45.5%	57.1%	-	53.3%	40.0%

When inhabitants were questioned about where children are in the habit of playing, streets were the first answer in all informal areas, and sidewalks and streets in Controls 1 and 2 (Table 7.46). Most adults judge that children now are unsafe when playing outside; the judgement is the same everywhere, although for different reasons (Table 7.47). In Santa Casa and Tucunduba the threat is contamination through falling into canals and contact with mud. In Santa Cruz and Paracuri, adults fear other children's violence (gangs) and vehicles (in Santa Cruz children play along routes of buses). In Arthur Bernardes, the threat is from vehicles (when children run into the road) and contamination. In Control 1, vehicles (probably in the avenue) and in Control 2, gangs, vehicles and contamination (Table 7.48 and Fig. 7.13).

	Table 7.46 **Children's play sites**. Occurrence per area (58.4% of interviewees answered this question)							
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Street	**19**	**20**	**15**	**8**	**14**	**5**	3	**84**
Sidewalk	6	14	4	**8**	4	1	**4**	41
Squares	9	2	5	3	6	2	-	26
Backyards	4	1	5	3	-	2	-	15
Empty plots		3			2	4	1	10
Canals		2			1	3		6

	Table 7.47 **How safe children are playing outside**. Occurrence per area (91.3%% of interviewees answered this question)							
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Very safe	7	3	5	10	1	5	1	32
Partially safe	9	7	12	9	8	4	4	53
Unsafe	**18**	**31**	**21**	**19**	**19**	**12**	**6**	**126**

	Table 7.48 A**dults' fears about children playing outside**. Occurrences per area (85.7% of interviewees answered this question)							
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Contamination	**26**	16	**21**	5	9	9	5	91
Vehicles	13	22	17	**26**	13	**12**	5	**108**
Other children violence	14	**25**	7	12	**17**	6	**6**	87
Others	3	3	6	12	2	-	1	27

Fig 7.13– Children on streets. Left: Toddler and adult walking in a street in Arthur Bernardes case study area. Middle: boys in the same case study area. Right: boys gathered in an alley entrance in Santa Cruz case study area.

When questioned about beauty, most inhabitants in Santa Casa and Arthur Bernardes have used the worst classification, very bad. In Santa Cruz evaluation was more positive, split between good and more or less good; in Tucunduba and Control 2, more or less good was the main answer; in Control 1 and Paracuri, good was the most frequent answer. Inhabitants made clear references to beautiful places within the city in all areas. The optimism in Santa Cruz may be justified by the

intensity of transformations that inhabitants have witnessed. Pavement is usually very highly valued, and this may be the reason for a more positive evaluation in Tucunduba, where the main avenue had been recently paved at the time of the fieldwork, and in Control 2, where inhabitants use the existing pavement to distinguish the formal settlement from the informal ones (Table 7.49) (fieldwork, 2000).

Table 7.49 **Perceived beauty conditions in the area and beauty references** (households per case study)

Perceived beauty 97.4% of responses		City Centre				Expansion area			
		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Very good		8.8%	9.8%	4.7%	23.1%	3.4%	4.3%	-	8.9%
Good		11.8%	**26.8%**	18.6%	**43.6%**	17.2%	26.1%	12.5%	23.6%
More or less		23.5%	**26.8%**	**46.5%**	20.5%	**37.9%**	26.1%	**56.3%**	**32.4%**
Bad		23.5%	12.2%	7.0%	12.8%	6.9%	13.0%	12.5%	12.4%
Very bad		**32.4%**	24.4%	23.3%	-	34.5%	**30.4%**	18.8%	22.7%
Total		100%	100%	100%	100%	100%	100%	100%	100%
Knowledge about beauty – city 88.3%	Yes	100%	97.3%	97.4%	97.3%	67.9%	100%	80.0%	92.6%
	No	-	2.7%	2.6%	2.7%	32.1%	-	20.0%	7.4%
Knowledge about beauty – district 75.8%	Yes	68.0%	45.5%	65.5%	65.6%	67.9%	92.3%	66.7%	64.6%
	No	32.0%	54.4%	34.5%	34.4%	32.1%	7.7%	33.3%	35.4%

It is easier to understand why Santa Casa's inhabitants consider their environment ugly when considering their evaluation of its poor cleanliness. Santa Casa is also considered a dirty place, as are Paracuri, which has a beautiful natural landscape and so might have a higher beauty evaluation, and also Tucunduba. Cleanliness is also said to be very bad in Control 2. In Santa Cruz and Arthur Bernardes, inhabitants consider cleanliness more or less good; Control 1 is the only place where most inhabitants considered cleanliness to be good (Table 7.50).

Table 7.50 **Perceived cleanliness conditions in the area and cleanliness references** (households per case study)

Perceived cleanliness 97.4% of responses		City Centre				Expansion area			
		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Very good		5.9%	4.9%	4.7%	20.5%	3.4%	13.0%	18.8%	9.3%
Good		8.8%	24.4%	16.3%	**35.9%**	10.3%	17.4%	18.8%	19.6%
More or less		26.5%	**41.5%**	30.2%	30.8%	27.6%	**30.4%**	12.5%	30.2%
Bad		**29.4%**	14.6%	16.3%	12.8%	13.8%	13.0%	12.5%	16.4%
Very bad		**29.4%**	14.6%	**32.6%**	-	**44.8%**	26.1%	**37.5%**	24.4%
Total		100%	100%	100%	100%	100%	100%	100%	100%
Knowledge about cleanliness – city 82.7%	Yes	90.0%	87.1%	73.0%	83.3%	39.3%	85.7%	66.7%	75.4%
	No	10.0%	12.9%	27.0%	16.7%	60.7%	14.3%	33.3%	24.6%
Knowledge about cleanliness – district 74.5%	Yes	85.7%	48.4%	57.1%	65.6%	46.4%	60.0%	53.3%	59.9%
	No	14.3%	51.6%	42.9%	34.4%	53.6%	40.0%	46.7%	40.1%

7.4.3.3. Social networks

When inhabitants were questioned about their relationship with neighbours, most answered that they were friends, except in the Arthur Bernardes case study. Control 1 is the place where neighbours are assumed to be friends most often, with strong links between neighbours who live in the same street. Control 1's inhabitants have the habit of sitting on chairs on the sidewalk to chat for many hours in the evening. This may be explained by their age (Control 1 has the oldest population surveyed), or by the clear definition of space roles. In the Arthur Bernardes case study, the description of neighbours as people whom inhabitants hardly know had the highest proportion of agreements; there people also demonstrated a wish to avoid connection with other inhabitants of the same street. These people say that they usually limit their contact with neighbours to greetings. They may be very supportive, as in the case of the family who provides water to thirty families near-by, but there is care to restrict excessive intimacy, probably to allow the usage of streets as semi-private spaces by most inhabitants (see chapter 6) (Tables 7.51, 7.52 and 7.53) (fieldwork, 2000).

In city centre case studies, chats were more often perceived in shops and churches, and inhabitants say that their friends are all over the district rather than in the streets where they live. In Tucunduba, there is a strong moral censorship imposed by religious beliefs that usually differentiates responsible families from criminals. In Santa Cruz, the communitarian centre is supportive of inhabitants' needs (it promotes parties to raise money to help a neighbour facing difficulties, maintains an improvised nursery, and asks for donations of food to give to the poorest inhabitants); and in Santa Casa the communitarian centre promotes campaigns to prevent malnutrition and illiteracy among young children (fieldwork, 2000).

Table 7.51 **Relationship with neighbours**. Occurrence per area (97.4% of interviewees answered this question)

	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 1	Total
Friends	**18**	**23**	**29**	**31**	**17**	11	**9**	**138**
People they hardly know	11	15	11	6	14	**12**	3	72
Relatives	6	3	5	3	7	4	1	29
Total	35	41	45	40	38	27	13	239

Table 7.52 **Location of friends within the district**. Occurrence per area (97.0% of interviewees answered this question)

	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 1	Total
All over the district	**23**	**26**	**34**	**26**	**30**	**13**	**9**	**161**
In the same street	6	7	4	10	2	1	2	32
None	5	8	4	3	2	10	-	32

	Table 7.53 **Evolution of neighbours' relationship**. Occurrence per area (93.9% of interviewees answered this question)							
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 1	Total
The same as before	**27**	**23**	**29**	**28**	**21**	**15**	**7**	**150**
Better	4	9	12	10	11	5	3	54
Worse	2	4	3	-	-	-	1	10

When inhabitants were asked about participation in formal organisations such as churches, clubs, associations and political parties, the church was the most frequently mentioned; one is usually attended within the districts and with multiple objectives (Fig. 7.14). Besides its spiritual work (the other main role), the church is seen as a social environment, from where people get information and sometimes help. An example is the case of a lady who lives in Paracuri with her children, who had her house built with financial help given by the church. Conversely, participation in clubs, associations and political parties was scarcely mentioned; clubs were more often cited in Control 1, reinforcing middle class habits; associations were more frequently cited in Santa Cruz, because of the communitarian centre. Inhabitants' rejection of political parties demonstrates either their scepticism about politicians' actions, or an acknowledgement that bargains at electoral times have more effective outcomes than party membership (Tables 7.54, 7.55 and 7.56).

Fig 7.14. Churches in Tucunduba basin. Left: Catholic chuch and parish centre on the boundary between Santa Casa and Control 1 areas. Right: The building with yellow façade is a branch of a very popular new Protestant church in Tucunduba case study area.

Table 7.54 **Participation in formal organisations**, number of responses (percentages follow alternatives)									
		Tucunduba basin – city centre				Paracuri basin – expansion area			
		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Church **64.9%**	Yes	22	26	29	29	18	10	12	**146**
	No	1	-	-	3	-	-	-	4
Club 12.6%	Yes	5	5	3	9	4	-	-	26
	No	-	-	-	3	-	-	-	3
Neighbour association 10.8%	Yes	2	10	1	1	2	3	3	22
	No	-	-	-	3	-	-	-	3
Political party 3.9%	Yes	2	1	-	1	-	2	-	6
	No	-	-	-	3	-	-	-	3

Table 7.55. **Place where people attend church**, number of responses (63.2% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
In the street one lives	2	6	2	5	-	-	1	16
Another street in the district	**16**	**15**	**23**	**20**	**14**	5	**8**	**101**
Outside the district	4	5	6	6	4	5	4	34
Total	22	26	31	31	18	10	13	151

Table 7.56. **Why people attend church**, number of responses (58.9% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Financial	1	3	3	-	1	1	1	10
Social	**7**	**6**	**5**	**13**	**10**	**4**	**3**	**48**
Support to domestic tasks	2	4	1	-	1	-	1	9
Information	2	**10**	1	3	1	-	**4**	21
Other	16	13	17	15	8	8	7	84
Total	28	36	27	31	21	13	16	172

When inhabitants were questioned about participation in informal organisations, most inhabitants said they take part in chats; most chats with neighbours happen in front of respondents' houses (Table 7.57, 7.58 and 7.59). Control 1 and Santa Cruz are the places where chats are most frequent, and Arthur Bernardes and Control 2 where they are most scarce. Sport practice (most of the time through football matches) comes next to chats; matches happen in football fields which have been reserved since the beginning of an invasion's settlement in expansion areas, in enclosed playing fields located in Santa Casa (inside school grounds), and in the street in Santa Cruz (described in Chapter 6 in the section on ligatures). Football is predominantly a male activity and the players consider themselves friends (Table 7.57,7.60 and 7.61). Parties are also common; they happen within the district and inhabitants attend them with friends; the case study area where parties are most frequent is Tucunduba; interviews showed that parties were associated with violence (Tables 7.57, 7.62 and 7.63) (fieldwork, 2000).

Other activities explored through questionnaires were childcare, community work and attendance at free courses; childcare was associated with relatives' help and was most common in Santa Casa, Tucunduba and Santa Cruz(Tables 7.57, 7.64 and 7.65). Community work was most frequent in Tucunduba, and has similar levels in the other surveyed areas, except for Control 1. Only in Santa Casa do inhabitants help people in other streets; elsewhere community work is usually restricted to the respondent's household surroundings (Tables 7.57, 7.66 and 7.67). Attendance at free courses is more frequent in Santa Casa, Tucunduba and Paracuri, and among strangers to the areas (Tables 7.57, 7.69 and 7.70). It was mentioned in interviews that the Catholic church, located between Santa Casa's informal settlement and Control 1's official settlement, promotes courses and training activities to benefit the poor inhabitants of Guama district (where Santa Cruz and Tucunduba are located).

Table 7.57 **Participation in informal organisations**, number of responses (percentages follow alternatives)									
		Tucunduba basin – city centre				Paracuri basin – expansion area			
		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Chats 54.1%	Yes	19	25	23	29	12	10	6	123
	No	-	1	-	-	-	-	-	1
Sport 43.7%	Yes	17	17	21	15	11	11	7	100
	No	-	-	-	-	-	-	-	-
Parties 32.9%	Yes	11	9	18	14	12	8	3	75
	No	-	-	-	-	-	-	-	-
Childcare 10.0%	Yes	9	3	5	1	1	1	2	22
	No	1	-	-	-	-	-	-	1
Community work 22.1%	Yes	7	8	11	4	7	7	7	51
	No	-	-	-	-	-	-	-	-
Free courses 10.0%	Yes	6	4	3	3	5	1	3	25
	No	-	-	-	-	-	-	-	-

Table 7.58. **Place of chats,** number of answers (53.7% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
In front of one's house	**11**	**23**	**21**	**27**	**12**	**9**	**6**	**109**
In another house of the street	4	2	3	2	2	1	-	14
In another street of the district	6	1	2	2	1	-	-	12
Outside the district	3	-	1	-	-	-	-	4
Total	24	26	27	31	15	10	6	139

Table 7.59. **With whom inhabitants chat**, number of answers (50.2% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Relatives	7	7	5	10	6	1	2	38
Friends	10	2	7	14	6	1	1	41
Neighbours	**11**	**16**	**17**	**15**	**8**	**7**	**4**	**78**
Strangers	2	1	-	-	1	-	-	4
Total	30	26	29	39	21	9	7	161

Table 7.60. **Place of sport practice**, number of answers (43.3% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
In front of one's house	1	3	-	3	1	3	3	14
In another house of the street	3	1	1	1	1	-	-	7
In another street of the district	**11**	**10**	**15**	**9**	**10**	**5**	**4**	**64**
Outside the district	8	4	7	2	2	4	-	29
Total	23	18	23	15	14	12	7	114

Table 7.61. **With whom inhabitants play sport**, number of answers (40.7% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Relatives	4	4	2	2	2	-	1	15
Friends	**13**	**12**	**13**	**14**	**9**	**8**	**5**	**74**
Neighbours	8	1	2	4	2	-	2	19
Strangers	2	-	1	1	2	-	1	7
Total	27	17	18	21	15	8	9	115

Table 7.62. **Place of parties**, number of answers (32.0% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
In front of one's house	1	-	1	3	-	1	-	6
In another house of the street	-	1	-	1	1	1	-	4
In another street of the district	**8**	**4**	**16**	**7**	**3**	**3**	**2**	**48**
Outside the district	5	4	5	6	5	5	1	31
Total	13	9	22	17	9	10	3	89

Table 7. 63 **With whom inhabitants go to parties**, number of answers (29.0% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Relatives	5	3	7	7	2	2	-	26
Friends	**8**	**5**	**11**	**8**	**8**	**3**	**1**	**44**
Neighbours	-	3	5	6	-	-	-	14
Strangers	-	-	1	2	-	-	-	3
Alone	-	-	1	1	1	1	-	4
Total	13	11	25	24	11	6	1	91

Table 7.64 **Place of childcare**, number of answers (9.5% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
In one's house	**9**	**3**	**5**	**-**	**1**	**1**	**1**	**19**
In another house of the street	1	-	-	-	-	1	1	3
In another street of the district	-	-	-	1	-	-	-	1
Outside the district	1	-	-	-	-	-	-	1
Total	11	3	5	1	1	2	2	24

Table 7.65 **Whom inhabitants rely on to look after their children**, number of answers (8.7% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Relatives	**4**	**1**	**4**	**1**	**1**	**-**	**1**	**12**
Friends	3	-	-	1	1	-	-	5
Neighbours	2	1	1	-	1	-	-	5
Strangers	1	-	-	-	-	-	-	1
Alone	1	1	-	-	-	1	-	3
Total	11	3	5	2	3	1	1	26

Table 7.66 **Place of community work**, number of answers, (21.1% of interviewees answered this question)								
	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
In front of one's house	-	**3**	**5**	**-**	**-**	**1**	**1**	**19**
In another house of the street	1	-	-	-	1	-	1	3
In another street of the district	**5**	-	-	1	-	-	-	1
Outside the district	-		-	-	-	-	-	1
Total	6	3	5	1	1	1	2	24

Table 7.67. **With whom inhabitants do community work**, number of answers (18.6% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Relatives	2	1	1	-	2	1	-	7
Friends	5	-	1	1	4	1	3	15
Neighbours	**2**	**7**	**8**	**3**	**5**	**-**	**2**	**27**
Strangers	2	-	-	-	-	-	-	2
Total	11	8	10	4	11	2	5	51

Table 7.68 **Place of free courses**, number of answers, (10.0% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
In front of one's house	-	-	-	-	-	-	-	-
In another house of the street	-	1	-	-	-	-	-	1
In another street of the district	**5**	**2**	**2**	**3**	**2**	**-**	**2**	**16**
Outside the district	1	1	1	-	1	1	1	6
Total	6	4	3	3	3	1	3	23

Table 7.69 **With whom inhabitants attend free courses**, number of answers (8.2% of interviewees answered this question)

	Tucunduba basin – city centre				Paracuri basin – expansion area			
	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Relatives	1	2	-	-	-	-	-	3
Friends	3	-	-	-	1	-	-	4
Neighbours	1	1	-	1	-	-	-	3
Strangers	3	-	2	2	1	-	1	9
Alone	-	1	1	-	-	-	-	2
Total	8	4	3	3	2	-	1	21

Table 7.70 **Evolution of transport conditions**. Opinions per area (93.1% of interviewees answered this question)

	Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Arthur Bernardes	Control 2	Total
Without change	49	20	29	30	30	12	6	176
Changed for better	4	10	5	8	5	2	3	37

7.4.3.4. Sub-conclusion to ligatures

This section investigates the trade-offs, motivations, values and networks of case study areas' inhabitants, in order to present the ligatures that make their lives feasible in the environment where they live. The trade-off between physical conditions and location was confirmed in all originally informal areas, except Paracuri. In all areas surveyed, location was pointed to as either important or very important, except in Control 2. Price was considered very important or important in all areas, especially in Arthur Bernardes. Potential for plot enlargement or subdivision was more valued in Paracuri and Arthur Bernardes than elsewhere.

Responses to the questions about the house were very similar to those given about plots. Inhabitants trade-off a site's physical condition, plot and house size and flexibility for a lower price

and better location. However, among the poorest, need is what actually controls plot and house subdivision, and is the reason for the generation of cramped housing in the best locations.

Investigation into perceptions of accessibility shows that Santa Casa, Santa Cruz and Arthur Bernardes have similar positive evaluations, Tucunduba's inhabitants were less enthusiastic, Paracuri's were confused and Control 2's were pessimistic. It seems that settling in Arthur Bernardes was motivated by trade-offs similar to those practised in the oldest areas, differentiated by the scale of accessibility in question. Arthur Bernardes' good accessibility is local, and generated by the importance of the road where it is located. Different from the typical situation among case study areas, its inhabitants had reasons other than poverty for settling in Paracuri.

Inhabitants' motivation was primarily economic; house ownership is a very important step in overcoming poverty, and re-sale is always a possibility if people can afford something better than what they have. However, it is not easy to sell a house, especially when the prices are high compared to the formal market, as is sometimes the case (prices rise when there are expectations of upgrade, and there is then speculative behaviour among sellers and buyers.

The assessment of physical qualities is diverse. In all settlements there is a perception of being in a good location, although the trade-off between location, house ownership, price and physical conditions is not perceived equally by all. Those who were initially poorest are the happiest; after years of struggles, inhabitants do not want to move, but they want a better place for their children in the future. There is also a willingness to welcome benefits more than to embrace obligations, expressed through the attempt to avoid tax payments.

Perception of safety is worse in the city centre than in the periphery, and is associated with mobility of population and increase in density, and is specially strong in Tucunduba case study area. In the expansion area, the enhancement of connections between the Paracuri case study area and its surroundings and the settling of newcomers improved original safety conditions. In Arthur Bernardes, the strong internal control and the unpredictable physical conditions are still constraints on outsiders' safety. Children playing outdoors are considered unsafe everywhere, although for different reasons: contamination in Santa Casa and Tucunduba, gang violence in Santa Cruz and Paracuri, and vehicles in Arthur Bernardes and Santa Cruz.

Perception of beauty depends on presence of infrastructure and level of cleanliness in the city centre, with more positive evaluations in Control 1, Paracuri and Santa Cruz. In the expansion area the natural landscape still helps the perception of beauty and pavement is considered an indicator differentiating the formal and originally informal areas. Santa Casa, Tucunduba, Paracuri and

Control 2 were considered dirty places, Santa Cruz and Arthur Bernardes were considered more or less clean and Control 1 was the only areas perceived as clean.

The consolidation of networks is clearer in the city centre, where neighbours are considered friends and friends are more often spread over the district. Control 1 presents the strongest links between neighbours living in the same street, perhaps due to inhabitant's time of residence and age, and clear definition of the role of space by the community. In the other areas, shops and churches are places where most chats are perceived as happening among neighbours living in the district; in Tucunduba the role of the churches is strongly emphasised to differentiate responsible inhabitants from criminals. In the expansion area there is a stronger need to create a limit to intimacy with neighbours next door, perhaps due to usual extension of the household space into the street space, and the need for solidarity without intrusion.

The sense of community is not evenly developed. Participation in formal communitarian associations is stronger in the city centre (strongly related to women's action); besides that, only the church is able to congregate inhabitants in all areas, the Catholic in the most consolidated areas and the Protestant in the poorest ones. Political affiliation is rare, since political bargains were usually more effective to bring about changes than engagement with a political party. Socialisation happens most informally, through front door contact, sports practice, and children playing, and is less usual in Arthur Bernardes and Control 2. But mutual support is usually related to strong bonds of friendship, created between old neighbours or restricted to relatives.

7.5. Conclusion

This chapter investigated the extent to which perception of inhabitants' life chances varies according to the place where they live. The case study areas were spatially characterised in Chapter 6 through analysis of location, configuration and timescale. The combination of these variables provided evidence about the present stage of physical consolidation of each case study area. In this chapter other dimensions of the process of consolidation are added in order to assess inhabitants' achievements and perception of life chances. Life chances were checked, initially, through the differentiation of case study areas' socio-economic profile, and more accurately, through the achievement of entitlements and the perception of access to provision and of ligatures. Section 7.4.1, on entitlements, checks the achievement of potentials expressed in Section 6.3; Section 7.4.2, on provision, checks the perception of access to material benefits and potentials presented in Section 6.4; Section 7.4.3, on ligatures, provides explanations of the relationships that inhabitants have with space.

The evidence gathered in this chapter is summarised as follows (Tables 7.71 and 7.72):

Table 7.71 Summary of case study areas' socio-economic profile	
Control 1	Majority of women; highest occurrence of several generations living together; occurrence of nuclear families and of large families; dominance of same district as previous living place; lowest number of children, highest number of mature adults; majority of workers in the public sector; high level of self-employment; higher levels of education.
Santa Casa	Balance between genders; majority of nuclear families; dominance of same district as previous living place; majority of workers in the public sector; highest proportion of full time students; maximum individual income of 5 – 10 MW.
Santa Cruz	Majority of women; highest occurrence of large households; dominance of same district as previous living place; highest number of children; majority of workers in the private sector.
Tucunduba	Majority of men; prevalence of nuclear families; highest number of teenagers; majority of low skilled self-employed workers; highest number with uncertain individual income; highest number of migrants.
Paracuri	Majority of men; majority of nuclear families; dominance of another district as previous living place; workers mainly divided between the private sector and self-employment; dominance of uncertain income. Maximum individual income of 3 – 5 MW.
Arthur Bernardes	Majority of men; households with maximum of six people; nuclear families, sometimes of single parents; highest proportion of another district as previous living place; non-existence of elders; workers mainly divided between the private sector and self-employment; maximum individual income of 5 – 10 MW
Control 2	Majority of men; majority of nuclear families; prevalence of another district as previous living place; workers mainly divided between the private sector and self-employment; maximum individual income of 3 – 5 MW.

Table 7.72 Summary of findings from sections on Entitlements, Provision and Ligatures					
	Santa Casa	Santa Cruz	Tucunduba	Paracuri	A. Bernardes
Entitlements	Easier access to education and formal work			Earlier school leaving, informal work, harder to resume education	
	Important land uses near-by to compensate for poor conditions such as poor health				
	High-skilled workers		Earlier work, low-skilled workers		Earlier work
Provision	Strong perception of street change, gradual improvement of houses				
	House as an asset for generation of complementary income			House as an asset for generation of principal income	
Ligatures	Common trade-off between worse physical location and lower price at the best location. Housing ownership as an important step to overcome poverty. Strong use value, but also conscious of speculative mechanisms in the assessment of a house's sale value				
	Existence of formal communitarian organisations Spatial communities are more consolidated			Stronger need of everyday solidarity	
	Perception of location is locally oriented				
	Worse safety conditions over time			Better safety conditions over time	
	Beauty associated with cleanliness and infrastructure provision			Beauty associated with natural landscape	

From this evidence it is possible to answer the research question posed at the beginning of this chapter as follows:

Achievement of better life chances regarding access to education and income are strongly affected by location. However, the perception of life chances was similar in households located in different

areas. Household needs, depending on internal composition and socio-economic profile, have a great deal of influence on life-styles and choice of living place, and determine different strategies to accomplish access to income and education. These are adjusted in accordance with available entitlements or alternatives.

Choices of location imply (and might also reflect) different levels of access to entitlements and different relationships with the physical and social environment. Generally, the less stable households are more easily pushed away to physically worse places, either globally or locally. Conversely, life style or attachment to cultural values is able to orient choice of location to the extent that household means permit it, resulting for instance in a choice to live either in places such as Paracuri or Tucunduba, the former as the choice for those who prefer less dense places and a countryside-oriented life, and the latter as a possible choice for those who prefer a countryside life-style but cannot afford to live away from the city centre (as they have no spare money to spend on transport, or need to make a living by taking casual jobs).

Households settled in the most consolidated areas seem to be better adapted to an urban life style and prepared to trade-off worse environmental conditions for better entitlements. Access to school, health care and other urban facilities is guaranteed by the trade-off of poor housing conditions. The gradual process of improvement is a strategy to make housing provision practicable in locations and economic circumstances where it would never be achieved otherwise. This achievement is equally valued everywhere, with inhabitants conscious of use value and understanding the potential of rises in house value. For households more mature in terms of urban life or somehow better-off, the perception of improvement is less than for those who were originally poorer. In Santa Casa case study area for instance, entitlements are favoured by the location, but provision is limited by stagnant physical consolidation; over decades drainage and landfill have been the only object of upgrade, without any concern for public space improvement, or adoption of infrastructure solutions or building regulations that could ease existing environmental problems.

Housing provision (in the form of house ownership) is an asset to overcome poverty, and sometimes to generate or complement income, depending on accessibility potential and amount of money available to invest in the activity. Inhabitants benefit from accessibility potential and fluxes of pedestrians adjacent to their houses which encourage street vending, or from privileged locations within the settlements, to open small shops or workshops. All these alternatives are present in the city centre, facilitating complementation of other income. In the expansion area, the adaptation of the house to create a place for an activity which generates the main household income is more common.

Spatial qualities are perceived differently in the city centre and expansion area. Accessibility or a good location is perceived locally, showing how well-adapted households are to the qualities and constraints of their environments, since the socio-economic profile shows that in case study areas located in the city centre, prospects of access to education and to regular income are more positive than in the expansion area. Safety is negatively associated with density and inhabitants' mobility in the centre, and positively with time and inhabitants' mobility in the expansion area. Perhaps more newcomers in the expansion areas are better positioned financially than those settling in the city centre. Beauty is associated with very urban values, such as good maintenance services and infrastructure provision, and with natural features in the expansion area.

Relationships within the spatial community are always strong. In all areas there is some degree of dependence on the community: in the city centre especially for street safety, and in the expansion area especially for access to water. How far the action of government and other agents in the physical configuration of case study areas have improved inhabitants' life chances is examined next.

Chapter 8
Contribution of Other Agents to Inhabitants' Life Chances

Chapter 8 Contribution of other agents to inhabitants' life chances

8.1. Introduction

The aim of this chapter is to investigate the action of agents other than inhabitants in the production and upgrade of informal settlements. Their contribution is observed according to their capacity to deliver entitlement through plans, policies and laws; housing and infrastructure provision through implementation of policies; and ligatures, through agents' paradigms of action. Afterwards agents are classified and have their level of participation in the process assessed. The empirical evidence produced answers the third research question: **are life chances improved and if so to what extent by the action of government and other agents in the physical configuration of invasion areas?**

8.2. The government and other agents' contribution to the land invasion process

The action of agents other than inhabitants or the process of informal production and upgrade is presented according to their relevance to each constituent element of the concept of life chances. This provides a clear picture of the correspondence between their contribution and the theoretical premises of this research.

8.2.1. The delivery of entitlements

8.2.1.1. Planning practice in Belém

Until the 1970s, urban regulations in Belém were very permissive. They favoured undertakings that expressed 'progress' and indicated the city's insertion into the country's new industrialised reality (e.g. incentives were given to multi-storey buildings, such as permission to cover the whole plot area). Regulations also tried to achieve idealised concepts of how the city should be (e.g. occupation should be restricted to levels higher than eight metres above water level). Meanwhile, a military dictatorship was in power in Brazil. When the dictatorship was established, in 1964 a National Housing Bank (Banco Nacional de Habitação, hereafter BNH) and a Federal Service of Housing and Urbanism (Serviço Federal de Habitação e Urbanismo, hereafter SERFHAU) were formed to reinforce the federal power within states and municipalities (Valença, 1992, quoted in Lima, 2000: 110). SERFHAU was created to set out urban planning guidance for municipalities, and BNH to provide the means to implement federal housing policies for the country's population (Lima, 2000: 110).

In 1971, the Company of Metropolitan Development of Belém (Companhia de Desenvolvimento Metropolitano de Belém, hereafter CODEM) was created to control the land tenure market and to

give support to the plans which were being set out. From then onwards, the grant of land in Belém was subject to effective occupation; CODEM became the controller of municipal land, which had occupation by inhabitants legitimised through the payment of a rate, the *foro*. In theory, this means that the municipality has first preference when buildings are sold. When one decides to sell one's property, CODEM should be told first, and, if it wished to do so, the Company can buy the property to install any social infrastructure the area might need (pilot study interview: Architect 2, Jan 2000).

8.2.1.2.The first generation of plans

In 1973 the federal government made official the creation of the nine Brazilian metropolitan regions, including Belém as the smallest one. CODEM was then commissioned to draw up the first comprehensive plan to promote the development of the Belém metropolitan region in co-operation with Para state government and BNH, in accordance with the methodology and means of implementation set out by SERFHAU (Lima, 2000:109). It was the beginning of a discontinuous planning experience in the city, characterised by long time lags between the elaboration of plans and the production of any outcomes from their proposals. The Plan of Development of Great Belém (Plano de Desenvolvimento da Grande Belém, hereafter PDGB, 1975) was the first

> comprehensive economic and spatial structure diagnosis of Belém metropolitan region and land use schemes, land use law and urban projects. The main objective stated in the plan was to guide the expansion and urbanisation of RMB [Belém metropolitan region] according to a decentralised concentration model. For that the plan presented the basis for development control through zoning law and projects for improvement of specific areas of the city [e.g.: the city centre] (Lima, 2000: p.109).

This plan was followed by a first analysis of waterlogged areas, commissioned at the city level, and called a Monograph of Waterlogged Areas of Belém. The monograph was written as a response to a federal and state proposal to upgrade the flood plains; the proposal financial sustainability would be achieved through the sale of the upgraded land. As federal legislation established that the land adjacent to any water stream was federal property, local architects and planners were sure that the flood plain inhabitants would be expelled by such a project, and the land would be delivered to the speculative land market, since within the Brazilian context of inflation, land was a safe and very attractive investment (IPEA, 1997:98; Payne, 2000:1).

Architects' and planners' appeals resulted in delays and the opportunity to prepare the Monograph, in which the social dimension of the problem was raised, postponing the launch of the macro drainage works for a further ten years. During the early 1980s local government revived the idea of cleaning the canals (and rivers) and of providing drainage and sanitation to waterlogged areas. Despite attempts to consider social infrastructure, a project of just physical infrastructure provision was designed. It has received $ 200 million, to be spent in the western portion of the city centre,

from the beginning of macro drainage works in 1992 up to the present (pilot study interview: Architect 1, Jan 2000; Trindade, 1998).

Despite the PDGB propositions about zoning regulations for the entire territory of RMB set out in 1975, only in 1979 was the first zoning law put into effect in Belém (Municipal Laws n. 7,119 and 7,121). It reinforced the existing expansion tendencies, and among other things established the search for the integration of urban areas, the avoidance of discontinuous urbanisation, the preservation of non-occupied waterlogged areas and of green spaces in the expansion areas, and rules of plot occupation according to local climatic demands (ibid: 134).

Also in 1979 the federal parcelling law, Federal Law n. 6766, was put into effect. It established legal and minimum physical standards for land parcelling in Brazil, such as a minimum plot size of 125 sq. m., the obligatory delivery of physical infrastructure by the developer, and the setting aside and donation of 35% or more (according to expected density) of a settlement's area to public usage (green areas and social infrastructure) (IPEA, 1997). This was the only parameter for formal land parcelling until the introduction of new concepts through the Federal Constitution of 1988, the watershed, when recognition that an informal city was in process of formation within most Brazilian cities was given.

The Municipal Laws were not orientated to tackle the informal production of space, since informal settlements were seen as temporary, and their inhabitants were expected to be rehoused in official housing settlements funded by BNH. The federal government had already decided to produce low income housing in the urban expansion areas by using low-density typologies. Such a policy reinforced the concentration of private investment and land uses in the already infrastructured city centres. Conversely, public investment in the cities' outskirts raised the value of intermediate land, which became unaffordable to low income people, and allowed the reservation of pockets of land considered unsuitable for urban occupation (such as the flood plains) and strategic to environmental protection (IPEA, 1997). 'Pirate' settlements, squatters and invasions in general have occupied these unsuitable areas. The flood plains close to the city centre were occupied first, since public transport was not reliable, and living close to the city centre offered more resources to low-income people. Gaps between official settlements built in the expansion area were occupied in a second moment (pilot study interview: Architect 2, Jan 2000; IPEA/DAU, 1997).

8.2.1.3. The second generation of plans

In 1980 another plan was drawn up for Belém metropolitan region, following a Marxist approach, and concerned with

> metropolitan development, job creation, housing policies to be achieved through a Política da Estruturação Espacial (spatial structure policy). This was developed into guidance for land use and density zoning. The plan also contained metropolitan management policy, with guidance for co-ordinating the implementation of all policies. Except for the spatial structure policy, all the other [guidance] consisted of broad recommendations to be implemented in the short, medium or long term (Lima, 2000:111).

The 1980s' plan was called the Metropolitan Structure Plan (Plano de Estruturação Metropolitana, hereafter PEM), and was the first to deal with concerns about natural site conditions and reduction of spatial segregation of low-income people settled in informal settlements. During the 1980s, the BNH was closed without clear justification[1]; its functions were transferred to the Federal Economic Caixa (*Caixa Economica Federal*, hereafter CEF), a public society responsible for the management of workers' Compulsory Savings over Time of Employment (*Fundo de Garantia por Tempo de Serviço*, hereafter FGTS) and the plan was not implemented (Lima, 2000: 111). This fact has reinforced the market orientation of the existing 'housing policy' and reduced the provision of low income housing even further (Valença, 2001).

The PEM was drawn up after the completion of a transport plan in 1979, which had set out a road network to improve public transport for the first time in Belém and its metropolitan area (Lima, 2000: 128). This fact made PEM's zoning proposals more realistic than the PDGB's, but it took from the latter the same concept of clear separation between residential zones and subcentres (ibid.:123). The residential zones were differentiated by plot occupation standards, set out according to proposed densities and permited land uses. In the expansion area, the existing road axes were taken as structural, to guide the creation of subcentres, without further proposals to improve the already recognised problematic situation of public transport and of accessibility to the city centre (ibid. :133).

The plan's proposals have inspired the 1988 municipal laws of urban development (Municipal Laws n. 7,401 and 7,452) and parcelling (Municipal Law n. 7,399), repeating the time lag of almost ten years between diagnosis and presentation of proposals for detected problems, and approval of these proposals as law. The 1988 laws represented a considerable advance in municipal regulations[2], because of the range of topics covered, ranging from historic heritage and distribution of functions through decentralisation throughout the city, to plot occupation and minimum building standards, applicable to local climatic conditions and building safety. (ibid.: 140).

[1] The Housing Financial System had its sources in a fund sustained by workers' compulsory savings, the savings accounts and the repayment of loans given for housing purchase. As the 1980s' Brazilian financial crises reduced levels of employment, there were more withdrawals from savings accounts and less repayment of debts, making the system impractical. Besides, it was in the political and financial interest of the presidency of Brazil and private banks to manipulate housing allocations in a more convenient and profitable fashion respectively (Valença, 2001: 29-42).

[2] The democratic opening-up and direct elections to mayors had already changed the political context, and isolated occurrences such as the collapse of a building, drew attention to specific matters needing to be put under control (Lima, 2000:138).

Many decisions were urgent, if not belated, in terms of city centre governance. The 1988 set of laws formalised a set of models to guide plot occupation, created to control the formal city, and to tackle the real estate market speculation (based on density control through restrictions imposed on high rise buildings rather than on land uses). However, the expansion area was still considered not urban; expansion areas were considered escape valves, without clear urbanistic purposes (IPEA, 1997:100), and did not received detailed guidance about their spatial organisation. The parcelling law was more an administrative than an urbanistic instrument, to the extent that it was more concerned to formalise the production of new developments according to the existing federal law, rather than to create complementary sets of instruments adapted to the reality of local social demands[3]. The law's innovation in this direction was the introduction of a minimum plot area of 90 sq. m. for social housing developments, against the 125 sq. m. determined by the 1979 federal law, following PEM's determinations (Lima, 2000:142).

The 1988 parcelling law concentrated on controlling the transformation of rural into urban land, through project approval and settlement permission to occupy in a strictly formal approach. This may have been due to the excessive fragmentation of the municipal institutional structure, and to the lack of information about the informally produced areas[4]. According to the 1980s' institutional structure of Belém municipality, upgrading was divided between three offices, each one covering a part of the problem. CODEM was responsible for land registration and street geometry, the Secretariat of Urban Control (*Secretaria Municipal de Urbanismo*, hereafter SEURB) was responsible for zoning the city, a third office called Coordination of Communitarian Action (Coordenação de Ação Comunitária, hereafter COMAC) was doing social research, without resultant physical action, in invasion areas. None of them was linked to the other (Lima, 1999). This situation prevented a holistic approach to regularisation that could have resulted in the effective integration of informally produced areas into the formal city, and in the promotion of inhabitants' participation in decision-making (IPEA, 1997:138).

According to the 1988 Municipal Law, the Tucunduba basin was classified as a ZH4, or residential zone, to be occupied by single storey houses, with a permitted building area up to 1.5 times the plot's area and the building to occupy up to 75% of each plot, and an expected density of 110/170 pp./ha. In this zone all businesses were permitted, and industrial and retail outlets of up to 1000 and 1500 sq. meters respectively were permitted. The portion of Paracuri basin covered by vegetation,

[3] According to IPEA (1997:138), Brazilian cities in which local laws were used as complementary to the federal law, establishing different standards for land parcelling according to local social demands, were more successful in tackling informal area upgrades and regularisation.

[4] Due to resource shortages, the municipality had cadastre maps produced only in 1973, 1977 and 1998. During the 21 years between the last surveys, there was a high level of uncertainty about how to link existing street patterns or to propose more effective upgrade actions. This favoured politicians' interests and deals, resulting in fragmented action and ownership (legal) regularisation, without proper urban (physical) regularisation and infrastructure provision.

southwards of the village where the Paracuri case study area was located, was designated as a natural resources protection zone, wherein any human occupation was forbidden. The area where the Arthur Bernardes settlements are located was established as a ZH5, or a residential zone, to be occupied by single and multi-storey buildings, with up to four times the plot's area, and plot area covered by building to a maximum 75%, and the same regulations as for ZH4, except that maximum area for retail outlets was 750 sq. m.

There was no proposal for land delivery policies for low income housing as yet. Nevertheless, it was publicly declared by planners involved in drawing up the 1988 Municipal Law, that, by making the single storey house the only allowed typology for the zone, they expected to protect low income people living in the ZH4 zone (corresponding to the flood plains and part of the expansion area) from expulsion due to speculative pressure (Fares Filho, interview given to the author in 1989). The 1988 Law has maintained the fictitious view of the impermanent nature of informal settlements, and provided the means to further segregate people living in the flood plains and expansion area. The legal restrictions, added to the site's physical limitations, have made the ZH4 zone very unattractive to private investment and to short-term reduction of physical and social distances between the city centre and informally produced areas.

8.2.1.4. The third generation

Ten years later, the city had already reached one million inhabitants and a second plan for transport was drawn up for Belém, with an accurate diagnosis and innovative proposals to improve the city's public transport network. The plan proposed the rationalisation of routes and their division into trunk and feeder routes. The latter would run in smaller vehicles into residential areas and, through transfers, connect passengers with bigger trunk buses (Lima, 2000:128,133-134). When the transport plan was concluded, a new masterplan was drawn up for Belém, the first to become law (the *Plano Diretor Urbano*, hereafter PDU, Municipal Law n. 7603), approved in 1992.

The main focus of the new plan was fully to incorporate the concept of the social function of the city, as introduced in the Federal Constitution of 1988, into the city management, in order to balance infrastructure distribution and public and private investment in the city. The informal areas needed the means to be upgraded in accordance with inhabitants' needs, and the periphery needed to have its accessibility improved. With the PDU, all the continental area of Belém, including the expansion area, became urban, for fiscal and planning purposes. This PDU did not alter previous recommendations and laws; instead it created new zonings and new taxation policies to raise money in high value areas, to be spent in the city's problematic areas, called Zones of Special Social Need (*Zonas Especiais de Interesse Social* or hereafter ZEIS)[5] (Lima, 2000:123-124).

[5] Lima (2000) gives detailed information about the new instruments and policies.

Lima (2000) describes the rationale as follows:

> PDU said that the total buildable area to be permitted results from the existing infrastructure in the land use zone (set out by the land use law) where the development is proposed. The plan holds that the infrastructure imposes limits on the total buildable area, as do the capacity of the public transport network and the road network. The two networks and the presence of infrastructure provide the conditions for Floor Area Ratios (FAR) to be established in different areas of the city. Total buildable area is established by the sum of the floor area permitted by a 'basic FAR' (incorporated in land use zoning), plus 'created soil', i.e. the 'extra' area to be 'sold' (under an additional zoning) in areas of the city with higher standards of transport and road conditions. Purchase of created soil is regulated by conditions in the zoning law. The PDU also established that in order to avoid creating privileges for landowners and the real estate sector, urban legislation should establish in each zone a potential buildable area, higher than the actual limit of extra floor area to be sold. The areas to have this increase in building rights are located in the city centre and along the main axes on the periphery. Money to be raised from this mechanism is to be spent on the urbanisation of Zones of Social Special Need (Zonas Especiais de Interesse Social or hereafter ZEIS) through the provision of infrastructure (p.126).

However, the new instruments needed complementary laws and further federal regulation to be put into effect. Local complementary law was approved in 1999 (Lei Complementar de Controle Urbanístico – LCCU, Complementary Law of Urban Control, No. 2) and the federal law dedicated to urban policy was approved in 2001(*Estatuto da Cidade,* City Statute*,* Federal Law n. 10,257). The LCCU created new zoning, adding control through land use to the existing plot occupation standards. All case study areas are under the ZH2 zone in the zoning regulation and all of them also are in areas of special need. The Tucunduba basin is inside a ZEIS, as is the Paracuri case study, and Arthur Bernardes settlements are in a special zone of environmental protection.

In terms of taxation, the PDU introduced progressive taxation on empty plots, in order to avoid retention of land by landowners over time; this instrument was waiting for further regulations provided by federal city statute in order to be applied, and for an accurate cadastre, which is in its final stage. The municipal taxation policy also decided to exempt from taxation any residential building with a value lower than R$ 16,852.06, approximately 94 minimum wages, corresponding to 52% of the buildings in the city, thus exempting low-income people (Magalhães & Nunes, 2002:5; IPPUR/UFRJ/FASE, 2001:59).

This new generation of laws represents a great deal of achievement in terms of recognition of the informal city[6]. They set out an urban policy in which the social function of the city is more important than private property rights, highlighting community participation in decision-making (democratic governance of the city) and urban operations carried out through partnership of private and public sectors. The approval of the city statute had been expected for two decades, and despite the

[6] Even the Federal Law 6766 was updated in 1999, in order to authorise the establishment of minimum plot sizes by local government for settlements of social need (Centro de Apoio Operacional das Promotorias de Justiça de Habitação e Urbanismo,1979/1999).

modifications imposed during the procedures by conservative forces (IPEA, 1997:141), this step forward will demand adjustments to the existing system of management in Belém.

It is remarkable that there has been a change of paradigms in Brazilian official regulation over time. However, all the efforts to provide legal means to upgrade informal areas have not yet been enough. In parallel to changes in law, there has been worsening of urban poverty, and more substandard housing conditions; besides this, laws always take a long time to be put into effect, and there are other forces (socio-economic) and interests playing important roles in the process (IPEA, 1997:112). The process of invasions and informal settlement creation is much faster and more dynamic than are the law procedures and the local government's capacity of governance, as the delivery of provision discussed in the next section shows.

8.2.1.5. Sub–conclusion to entitlements

This section is dedicated to the discussion of how much policies, plans and laws applied in Belém have delivered entitlements to inhabitants of informal settlements, particularly in the areas taken as case studies in this research. The chronology of planning activities and forms of regulation in Belém followed clearly the typical patterns generated by the macroeconomic context in which developing countries were immersed, presented in Chapters 2 and 3.

The evolution of planning and regulation was a result of the articulation of actions at different levels of government, intensified from 1964 onwards (when the military ditactorship was established). Table 8.1 provides a brief summary of this evolution, associating actions with the level of government most directly involved with them.

Table 8. 1 Chronology of the delivery of entitlements by the different levels of government in Belém			
Time	Level of government		
	Federal	State	Local
1964	Creation of BNH (to provide means to implement housing policies) and of SERFHAU (to set out urban planning guidance to municipalities)		
1971			Creation of CODEM (to control land tenure market and to support local planning activities)
1973	Creation of Brazilian metropolitan regions (Belém Metropolitan Region inclusive)		
1975	Presentation of a proposal of macrodrainage that would deliver the upgraded land to the speculative land market. The proposal was postponed, thanks to local reaction, to give time for further studies		Conclusion of PDGB and commission of the Monograph of waterlogged areas of Belém.
1979	Federal parcelling law was put into effect		First city zoning law was put into effect (informal settlements were consided temporary: concentration of investment in the already infrastructured areas of the city). Conclusion of the first transport plan of Belém
1980 -	Closure of the BNH	Revival of the macro-drainage project (physical infrastructure provision without social infrastructure counterpart)	Conclusion of PEM (more realistic proposals, concern with environment and spatial segregation). First actions of upgrade in Tucunduba basin.
1988	Enactment of present Brazilian Constitution		Municipal laws of urban development and parcelling were put into effect (time lag of almost ten years between diagnosis – PEM, and implementation of proposals)
1990			Conclusion of the second plan of transport (the population reaches one million inhabitants)
1992		Beginning of macro drainage in Una Basin	Belém Masterplan was put into effect (commitment of full incorporation of the social function of the city). Need for complementary laws.
1999			LCCU – complementary law was put into effect
2001	City Statute was put into effect (juridical support to urban policies and new instruments of control regarding the social function of the city)		Conclusion of the municipal cadastre

The strong connection of Belém's urban management with macroeconomic circumstances has favoured conservative approaches to planning, and has resulted in biased laws and policies. Official policies were completely orientated to formal production of space, despite the scarcity of means and

local social circumstances, resulting in concentration of private investment and land uses in the already infrastructured areas of the city. This caused a rise in land values in these areas, making them unaffordable to low income people.

Informal settlements were initially seen as temporary, and neither federal nor local laws were oriented to tackle informal production of space. The posterior acknowledgement of their permanence was not followed by reflection or search for proper solutions to their spatial and environmental problems. Local government concern about speculative mechanisms led to adoption of simplistic measures that were meant only to prevent gentrification. No further actions were undertaken to tackle the problem from a wider perspective. The lack of information (non-existence of a cadastre), of integration between different sectors of the municipal structure and between programmes carried out by different levels of government resulted either in government omission or complete imposition of physical changes on informal settlements' space. Sanitary measures were more routine and easier to undertake, from the government perspective, than actions based on new instruments and policies. The latter were created to tackle the land market speculative strategies which were behind the process of socio-spatial segregation present in Brazilian cities, but have had a very slow process of maturation and received the required juridical support (awaited since 1988) only last year.

There is a trend of positive change regarding entitlement prospects for informal settlements. However, the usual time lag between propositions and implementation of policies and laws, the discontinuity of reflection about proposals and lack of continuous and integrated planning, are still serious constraints to be overcome. The legal achievements have always been behind the increase in complexity of the low-income housing provision issue. This is shown in the next section.

8.2.2. The delivery of provisions

8.2.2.1. Local provision of land

According to the tenure system of Belém, by the time it was created, CODEM had the full domain over the land corresponding to the most urbanised area of the city (the first league area). The Company was responsible for management of this land and the issue of concessions for the right to use its surface to any land consumer. The federal government was the owner of rivers and water stream banks; and private landowners owned unurbanised areas, which had been requested from the municipality inside and outside the first league limits before the creation of CODEM, as explained in Chapter 3.

The request for land, previous to its occupation, was a common practice in Brazil from colonial times. The time of possession of land determines its respective ownership by *usucapião* (a judicial

concept that transforms possession into property, by transferring ownership from the legal owner to the user after a certain period, usually five years) according to the Brazilian Civil Code (IPEA, 1998:113). The size of properties was established according to the amount of land requested; this allowed the formation of large landed estates on the city's outskirts by the mid 20th century. These corresponded to the waterlogged areas and the present expansion area. These areas were not entitled to be parcelled according to the existing development law, because they were either lower than the acceptable level (eight meters above the water level), or were outside the urban area (Dijk & Figueiredo, 1998:116). As there were no development policies to guide occupation, landowners could keep these areas reserved, waiting for valorisation; informal developers could sell waterlogged plots demarcated according to fictitious layout drawings[7] (pilot study interviews: Architects 1, jan 2000; fieldwork interview: Architect 2, Sep 2000).

8.2.2.2. Local provision of low income housing – official action

In 1965 the state government created the Housing Company of Pará State (*Companhia de Habitação do Estado do Pará*, hereafter COHAB), aligned with the federal government's policies of housing provision. COHAB was created to implement low income housing programs in the state, and became the most important agent for the consolidation of the expansion area of Belém. COHAB worked as an *incorporadora,* to use private sector jargon, or a company that bought the land, requested loans, commissioned projects and building services to build official settlements, inspected the works and sold the houses. The difference was that COHAB did not incorporate the profits generated by the development into the final price of its houses (Dijk & Figueiredo, 1998: 135-136). The first official settlement produced by COHAB was built beyond the first league, in 1969, to relocate inhabitants from a flood plain which had been upgraded and become part of the city centre; this land was fully incorporated into the real estate market (Cardoso, 1994, Trindade,1997).

The later official settlements were built further from the city centre, towards Icoaraci Village (and Paracuri basin) and Ananindeua (the neighbouring municipality), where land was cheaper and massive housing construction was possible. This was built with low densities typologies, and demanded extension of all infrastructure. It was clear that there were concerns other than low income housing provision; this was an action of development to strengthen the building industry, the most important local industry, by generating work and income in the Belém Metropolitan Region (Veras, quoted in Peruzzo, quoted in Dijk & Figueiredo, 1998:135).

[7] According to Mourão (1987:111-112) private landowners of floodplains have pretended not to notice invaders for decades, or the time taken to make environmental transformation irreversible. After that had happened, they appealed to the courts to regularise the occupation by selling the plots to their occupants, based on current prices of the land.

8.2.2.3. Housing provision adjustments, private and official action

This action prompted the private sector to build housing on the outskirts of the city, similar to the official settlement in Guamá district, taken as Control 1 area, near the Santa Casa case study area. By the 1970s, smaller contractors were working in many other districts considered as peripheral at that time, and just beyond the first official settlement built by COHAB, while the big contractors were working on COHAB's official settlements in the expansion area. The private sector has always been cautious in choosing locations, and has waited for public sector investment before proceeding. (ibid, 136,141).

During the 1980s, with the closure of the BNH and disruption of the SFH, COHAB suspended the production of official settlements and the private sector had come back to the city centre to produce low income housing in a new fashion, by adopting four storeyed buildings without lifts (ibid.:147). This housing was no longer directed to low income families, since interest rates applied to housing loans were higher than retail price indexing applied to compensate for inflation in wages. This caused a lack of payment for existing projects, and suspension of funding for new ones (Valença, 2001:36).

The federal government created new alternatives for investment to refresh the building industry after the difficulties of the 1980's economic adjustment measures. During the 1990s, the private sector was dedicated to massive production of very cheap low-density official settlements, in order to raise funds for investment to be applied in the more profitable upper class projects (low density condominiums were also located in the expansion area) (Dijk & Figueiredo, 1998: 154). Meanwhile COHAB started to promote upgrading of informal settlements, and provision of site and services for housing in the expansion area, and recently, after administrative changes, has resumed housing production for state government employees through two different programs. One is for workers with monthly incomes from six to twenty times minimum wages, and another for workers with up to five minimum wages of monthly income. Meanwhile, CODEM has carried out tenure and urban control regularisation in the city centre and expansion area (Lima, 2001).

8.2.2.4. The official presence in informal settlements – tenure regularisation and upgrade provision

During the 1980s CODEM's personnel tested a few strategies concerning informal settlements. One was to install advance offices in informal areas, to enhance the possibilities of tenure regularisation. These offices provided an experience of decentralised management, in which the technicians were much closer to the community, to negotiate viable solutions to existing conditions of occupation. Technicians also had authority to contact specialised agencies in order to sort out local problems (e.g.: leaks in water pipes). Despite the helpful quality of this experience, it was not incorporated as an institutional policy, and was suspended (pilot study interview: Architect 2, Jan 2000).

During the 1980s technicians witnessed violent fights between invaders and policemen sent by the government at the request of landowners (pilot study interview: Architect 2, Jan 2000). The violent and authoritarian actions to expel invaders prompted solidarity between the progressive wing of the Catholic church, institutions representative of professionals, among intellectuals, with invaders, established years before. They all supported the 'right to housing' campaign, and left-wing politicians joined the invaders' cause. The situation caused a political struggle in the city, but seemed not to improve planning regulations or laws /plans approval that would benefit informal settlement regularisation (pilot study interview: Architect 3, Jan 2000).

Santa Cruz was a community engaged in the movement to claim land from the huge Federal University of Pará property. The dispossession of such a big area by the creation of the university was an impressive demonstration of federal government power, considering the small portion of the land actually occupied by the university campus. Negotiations have been pacific, and the university personnel were always supportive of invaders - different from cases where the land belonged to the Air Force, for instance. The political struggles have resulted in political solutions most of the time. Improvements were dependent on the mayor's will to tackle the waterlogged settlements' problems. For instance, rubbish was used to landfill streets, and raised wooden walkways were built to replace trunk pathways, paid for with public money for the first time, allowing access by two-wheeled vehicles, and provision of many delivery services (fieldwork interview: Architect 2 and 4, Sep 2000).

Box 8.1. Wooden raised walkways as an achievement in informal areas

> I have walked on a two plank walkway; when we walked we went down [and used to think]: I will fall in this water! Then, right away there was a very good idea by Almir Gabriel [city mayor during the late 1980s]. He started to designate and to build raised wooden walkways with 1.5 meters of width; the inhabitants used to build the paths before. When I saw the motorcycle delivering pharmaceuticals at the inhabitant's home!
> The two wheeled cart delivering gas jugs; this was a big progress! This was when the pre-manufactured concrete industry appeared [it was municipal property]. But it did not thrive; the entrepreneurs did not allow it. The concrete was cheaper than the other materials [the mortar pre-manufactured elements were used to cover canals' laterals, to build raised walkways, urban furniture and drainage ditches] (pilot study interview: Architect 2, Jan 2000).

The macro-drainage project was launched in 1986, at that time as a partnership between local and state government, to benefit the plains facing Guajará Bay through provision of physical infrastructure (landfill, drainage, water, sewerage and pavement) and tenure regularisation. CODEM acquired all private land, to be sure that all invasions would be located on municipal land; such a measure has been helpful in cases of relocation, since only buildings had to be compensated for. Besides participation in the macro-drainage project, CODEM has promoted physical and tenure

regularisation, always at a community's request, and CODEM either owns or receives a donation from landowners of the land invaded.

However, the process of regularisation is long and complex. Physical limits must be defined, in order to allow a project design to go ahead in the Urban Secretariat, and project approval is needed from the Sanitation Secretariat; then the Financial Secretariat provides street numbering for plots, and CODEM is ready to concede the right of use against payment of the respective tax (the foro). The person then should go to a registry to receive the title certificate and present it back to CODEM. The title describes the legal limits of a plot as an historical document to allow future checking in case of disagreement. The process is hardly ever completed, despite the low taxes charged by CODEM and the clarification provided by CODEM's personnel in meetings with the community (fieldwork interview: Architect 2, Sep 2000).

People usually sell plots before regularisation is complete, without communicating the transaction to CODEM. This causes suspension of the process. The new owner cannot obtain the title before the previous owner formally gives it up. In case of existing plots, a reduction of size due to future requirements for streets is frequent. Inhabitants seldom modify fences, and usually 'sell' the public land they occupy, pretending they did know about the legal plot limits. In such situations they hide the documents, or prevent them from being fully read. They usually believe that they have more security by investing in more expensive materials, such as brick and mortar, even though they use these materials to build on public space. The success of these actions depends on the community's engagement and interest (fieldwork interview: Social Developer 1, Sep 2000).

Unlike the areas benefited by the macro-drainage project, the Tucunduba basin's invasions have not experienced extensive regularisation, since most of the land belongs either to private landowners or to the Federal University of Pará. This basin has had more isolated and disconnected upgrade actions, depending on the availability of funding (Interview: Civil Engineer 1). The first upgrade actions were financed by the local government and the FGTS, the CEF's fund that finances housing provision and is the main financier of physical infrastructure. The municipality has requested loans to build canals, landfills and to pave streets; the money must be repaid, in instalments over15 years, from six months after work has finished.

During the 1990s, the federal government created new programmes to finance abnormal settlement upgrade; the money is provided by the Inter-American Development Bank (Banco Interamericano de Desenvolvimento, hereafter BID) and must be matched by a municipal counterpart. BID's money does not have to be refunded, and has been easily diverted to other work, to suit political interests. These projects do not provide technical assistance to inhabitants, nor funding for plot landfill. They have improved accessibility and integrated previously flooded areas into the adjacent space, after

inhabitants' hard work in transforming the natural environment. Nevertheless, upgrade programmes have not completely changed the site's previous characteristic of being flooded, since isolated action has established incompatible street levels in different parts of the basin. Today, the higher portion of the basin is lower than it should be, perpetuating floods during rainy seasons (fieldwork interview: Civil Engineer 1, Sep 2000).

Box 8.2. Patterns of money expenditure in Tucunduba basin

> …to Gentil's, Cipriano's, Mundurucus' canals, there was an allocation of 6 million[reais] from the Habitar Brazil program obtained through a Vic's [a state congressman] amendment, which in fact had been used at the end of Helio Gueiros' term of office [the former city mayor] (…) Once more local, state and federal governments have made the same mistake, because the works are programmed according to the time the mayor will stay in power. What happens then? The money is pulverised; it is not used only for that area; in order to relocate families I need to offer another alternative, although the program does not demand a counterpart. The municipality has to bear the cost of relocation of those families to a better place. The experience was very bad, because there was a great distance [from the original settlement] to Eduardo Angelim [the official settlement built by local government to relocate families in the expansion area]. (…) There was a time limit to the municipality account for the money expenditure, since it does not need to be refunded; it comes from the Brazilian federal government budget … the municipality had to use the money to deforest the Eduardo Angelim area… because of that some projects were suspended before their completion. (…) Conversely, once more it was started wrongly. What was correct? When you execute a project with such characteristics as in Tucunduba basin, the right thing is to advance from the lower to the upper levels … What was the excuse? There was the oldest drainage project, funded by FGTS, called Inframarco, which comes from the upper area, and created all these problems. That will never be sorted out; there will always be floods when high tide coincides with highest rainfall (Civil Engineer 1, Sep 2000).

COHAB's action in settlement regularisation during the 1990s was even more politically orientated. A state governor adopted procedures to please everybody involved in the invasion process; he had promised in his campaign, and gave, after elected, compensation to landowners[8] and titles to invaders. This has prompted small invasions overnight in unoccupied land all over the city, a trend called by many local authors the 'invasion industry' (Trindade,1998:184-220). As the state company for housing matters, COHAB has even assumed titling regularisation, overlapping in function with CODEM, during that time. Paracuri case study area land, for instance, was dispossessed through the state decree n. 170, of 25/10/91, and was made a pilot trial of regularisation funded by the *Habitar Brasil* programme (established with World Bank resources) (fieldwork interview: Civil

[8] This did not have juridical justification, since landowners could be considered negligent with respect to the social function of their properties, according to the Civil Code. Obviously, compensation might work as a prize to landowners who keep land as a commodity (IPEA, 1997:113).

Engineer 1 Sep 2000). COHAB also has provided infrastructure for existent and new settlements, using this same programme.

Box 8.3. The upgrade of Paracuri case study area

> [In Paracuri] We have first checked the landowner's legitimacy. Once identified, the landowner has agreed to receive compensation; the land was a family inheritance - and there was the candidate's compromise of compensating for the land, with the aim of regularising [the situation] in order to keep people living in the place. There was the decree, …, the value was paid, the landowner kept a considerable portion of land … he even had a fish livestock farm beside the invasion; and for instance, respecting what had been defined by inhabitants, we made surveys to organise the street alignment in accordance with Icoaraci's street layout… we had a lower and a higher area, … in the first we have tried to align the streets, relocating the houses in the middle of planned streets to the higher area, where COHAB planned to build an official settlement. … to tell the truth the aim was votes. What was done? A survey, a cadastre, to form a database… to identify people and have a kind of control and future tracking of inhabitants…. In the first part [of the project], I remember that a school was built, an extension to the school, a square [was built], electric power was extended. The inhabitants wanted a health centre, school, public transport, tenure regularisation. We had to inform them of what they had been given, that the resources were limited…. When this part was completed, we began on the highest area, on the football playing-field. We planned to connect both areas, but we were not allowed…. Paracuri was the first area that we have not completely deforested…. I am not sure, but 200 or 300 houses were built through communitarian work and an alternative constructive method… We expected to complement the project [urban design], but too much had to be done with infrastructure, deep and superficial drainage, sidewalks, - there was no continuity. Plants were planted, it is beautiful today…. There was a mistake, the water provided was very bad quality… Some facilities were built [another school] to receive the settlements' inhabitants only…. There were political problems, political interests. The lack of political articulation was inside and outside COHAB. We found solutions among technicians, but there were problems at a higher level that prevented us doing what we should have done (fieldwork interview: Civil Engineer 1 Sep 2000).

8.2.2.5. Achievements in housing provision

The formal production of low-income housing has always been smaller than the social demands for it. Despite the cited investments, from 1965 to 1991, COHAB produced 20,04% of the wanted low income housing in Belém (IPEA/DAU, 1997:48; IPPUR/UFRJ/FASE, 2001:86). COHAB and CODEM regularised 38 informal settlements up to 1997, benefiting 28,128 families (ibid,:46). In 1998, the municipality created a Housing Secretariat (*Secretaria Municial de Habitação*, hereafter SEHAB), to plan, execute, assess and control housing activities within the city. SEHAB is now in charge of municipal housing production, funded by CEF, for relocated people from regularised invasions. SEHAB also has partnerships with NGOs to finance building material, basic baskets of material for families with a monthly income of one up to three minimum wages. This secretariat has many administrative problems, especially related to insufficient technical personnel (Lima, 2001; IPPUR/UFRJ/FASE, 2001:96).

Local government has also requested money from the Habitar Brasil program to regularise the Tucunduba River, providing drainage, water, sewerage and green spaces for the river's adjacent areas; after many struggles, the money was released and up to the present, relocation procedures are in progress (Fig 8.1). The project presents advances in relation to previous experiences, through a higher commitment to social and economic aspects. However, political orientation still prevails over technical solutions (the project does not benefit from the legal mechanism available to the area, and has spatial solutions oriented to tourism as much as to the needs of local inhabitants[9]). The solutions presented have been proved inappropriate to the target population because of the higher level of gentrification noted in the area through research carried out by Oliveira *et al*. (no date: 23-24).

Fig 8.1 – Views of Tucunduba river bank. Top: Dec 2000. Bottom: Jun 2000.

Nowadays, the determination of which areas are to be benefited by Habitar Brasil is expected to be the result of inhabitants' decision-making in official meetings promoted by the local government, as part of the Participatory Budget (*Orçamento Participativo*, hereafter OP). Unfortunately, despite the success of the OP in other Brazilian cities[10], it is still an obscure instrument in Belém. Political compromise has prevailed over social compromise, and works chosen to be carried out are always related to places where the majority of inhabitants is supportive of the political party in power, no matter what the technical demands or the financial sustainability prospects of the project (fieldwork interview: Civil Engineer 1, Sep 2000).

Box 8.4. The participatory budget in Belém

> The OP as carried out in Belém is not the same as that carried out in Porto Alegre. It consists in the famous inspection committee that they call COFIS [comissão de fiscalisacão]. The population is supposed to be participatory and enquiring. This is a falsehood; you are manipulating human beings. This criticism is of the officers; they are people who have political power rather than seeking social compromise. [They say] I am so-and-so, I belong to such [political] tendency, it has to be like that…. They do not tolerate technicians; they say we [planners, engineers] are only technically oriented … they say 'there you come with your technical chat; you do not solve anything'. I reply that we give sustainability to any political

8.2.2.6. Sub-conclusion to provision

This section discusses the provision of land and of low income housing in Belém, as an outcome of the policies and legal instruments presented in the previous section.

From what was presented in Chapter 3 it is already clear that land delivery in Brazil has historically been biased towards the elite, since limits to the size of properties were never established. The tradition of request for land prior to occupation indicates an earlier very relaxed attitude, related to urban space, which has survived in urbanisation of previously rural land. This combination between the elite's self-interest and the tradition of occupation of land previous to ownership, especially by the poorest, has proved to be much more influential in sheltering the poor than the legal instruments of planning and management.

Insufficient provision of low income housing (due, for instance, to inadequate policies and lack of co-ordination between existing legal and technical mechanisms of urban control) resulted in the informal production of space. The complex origins of this process in the macroeconomic context, discussed in Chapter 3, show its strength and explain why actions meant to tackle housing shortage are so easily associated with other aims, such as strengthening building or tourism industries in developing countries. The official concern to maximise the return of public investment has resulted in higher benefits to stronger social groups, better represented in power, than to the low income groups, and in housing production always smaller than social demands.

In Belém, low income housing provision was launched by the state government with the creation of COHAB in 1965, showing that actions related to provision were structured before the strengthening of entitlements through legal instruments of urban control. The massive construction of official settlements occurred before the definitions of planning strategies for the city development, set out in the 1988 laws. Local government was not able to connect official and private actions of housing and infrastructure provision to other aspects of the city's development.

[10] About Porto Alegre experience see Abers (1998) and Souza (2002, 433-435).

The full implication of the use of space was not understood or considered properly, and expectations were too high and too much power was left to political decision-makers. The prevalent concern with space, in terms of origin and destination of transport, and consideration of space only through large-scale zones, prevented understanding the role of other spatial scales for the city and for street configuration, and the process of consolidation of informal settlements and their eventual introduction into the formal land market. The belief that investment only in regularisation and infrastructure provision would result in consolidation of informal settlements has failed in the Paracuri case study area, for instance; it presents the highest level of gentrification among case study areas, from the time of newcomers settling to upgrading actions. Moreover, the investment was not enough to provide inhabitants with life prospects similar to those enjoyed in informal areas located in the city centre. Far from that, the experience gave a clear lesson about how to increase invaded plots in value, and fostered the new 'invasions industry' in Belém, shown in the next section.

8.2.3. The practised paradigms as ligatures

The delivery of entitlements, through regulations and plans, and of housing provision through housing policies, to low income people, has been conditioned by political perspectives which have varied according to the political context. The federal government's orientation has always strongly affected formal and informal housing outcome. The 1970s centralised power structure has detached social from technical solutions. It diffused a technical paradigm of physical intervention, based on the best technical choices, over all levels of government. From federal funding agencies to municipal secretariats, legal parameters were established according to ideal technical solutions, despite economic restrictions and social demands.

Centralisation also created an official attitude of control from above, rather than of people's continuous participation in socio-spatial processes. The Brazilian government expected to correct 'anomalous' patterns, such as invasions, with authority, and has forgotten the social causes of these anomalies. This strong power of government has favoured a mix of different economic aims in the same action, such as the promotion of nation-wide integration and the development of a local building industry through housing provision programs executed in Belém (Dijk & Figueiredo, 1998). Economic priorities have meant inadequate investment to meet the final users' expectations. The policy of building huge official settlements on the cheapest land has actually boosted the building industry, but has not provided housing for low income people as expected.

Box 8.5. Recent experience of Tucunduba's inhabitant's relocation

> …It would be a relocation to next door, but we would settle the inhabitant in a very beautiful street, served with sewerage, water, drainage, paved streets, power, all the best… A person would have to pay taxes, power and water bills, and cannot afford it. Neither has the project spare money. How can we execute a program without providing better [economic] opportunities for inhabitants? We had an experience in the municipality; we have moved people from Tucunduba to Eduardo Angelim. The Eduardo Angelim house cost seven thousand reais, and new inhabitants sold them for two thousand. Why? The person is there, but has to survive; previously he did not pay for transport, now has to do so without having the money. He/she will die. This outcome results from the following misconceptions: the project has to be executed in two years, the work has to be done in two years,…From our observation, in such a type of project, you need to build the street layout day-by-day… . We [architects, planners, engineers] create a reality in our minds different from theirs. It does not work. We can design their houses, pay for the building material, tell them how much it will cost, but we cannot guarantee that they [the inhabitants] will build that house… . [Furthermore] How is the street layout going to be? We can arrange three blocks from two, but we also may join six blocks into one. They decide; we can improve things, enlarge plots, but what we can do depends on them (fieldwork interview: Sanitation Engineer, Sep 2000).

The same top-down attitude was present in the adoption of macro-drainage solutions, carried out separately from urbanisation and social programs. Moreover, there was political interest in using the scale of intervention to draw attention to easier access to loans for these types of work. The Brazilian housing sector has always been structured to support the more complex and expensive technical solutions, and to work with the biggest enterprises (presumably more reliable, but also more powerful in helping electoral campaigns or in taking part in corrupt schemes) than with case-oriented approaches.

Box 8.6. Divergences between funding agencies and local government personnel

> What matters is to get the money, to guarantee that it will arrive and that the work will be done. It does not matter how it will be done, who is going to supervise, or who has the money. This was the big issue. We have questioned the manner this money was being used. It was money from 'Habitar Brasil', a program for the community,…. They have sent R$ 6,000,000.00 through Vic [a politician]. And what has happened? They have built several projects, such as Cipriano Santos', Santa Cruz's, Mundurucus', and Gentil's canals; there were also several streets to receive landfill and ditches and one street where they wanted to build concrete raised walkways. We have questioned these projects, but what I thought was more complicated was the investment of money in an area which was not ready to receive it. I have started to claim that we should work in the Tucunduba River first [which receives the water from all the other canals]. But CEF has not accepted this; it said that we could not change allocations, that we should be happy to do these works, that we had to use the money as was programmed, without further questioning (fieldwork interview: Sanitation Engineer, Sep 2000).

While urban policies and respective instruments have advanced slowly to incorporation into regulations, health and sanitation measures were more quickly defined and readily applicable, since sanitation work has been carried out in Brazil since the early 20th century (Villaça, 1999). This might explain the paradigm established by the macro-drainage works in the flood plains located inside the city centre of Belém. However, the repetition of such a paradigm in smaller infrastructure projects has been harmed by the haste to meet deadlines, and by strict parameters imposed by funding agencies. This has created a problem over time: the rise of the belief that the political opportunity and the politician would be more important than the technical solution, since the latter would always be decided according to an ideal standard.

Box 8.7. Example of the power of the political decision over technical needs

> [About] The political mistake issue, [the politician] always works to four years [a term of office]. What happens? They start to dream, to think the difficult and forget to do the easy, the basic; time goes, what happens? Pulverised action: take a machine from here, put it there, we need money, transfer allocations, absolute craziness! It has happened in all terms of office, at all levels of power. When you pulverise actions you have disconnected works (fieldwork interview: Civil Engineer 1, Sep 2000).

Box 8.8. Financial resource limitations or new localised macro-drainage works

> I think it is not possible to have an integrated action [drainage of streets and plots]; the cost is too high. The municipality cannot afford it. What has been done? The municipality could borrow R$ 55,000,000.00, then we went to CEF [during the late 1990s]. They have promoted the loan that was interesting to them, but when it was time to get the money, what happened? First the city mayor said that he wanted all work done in 100 months; but when we asked for the money, we were informed that the maximum loan was 7 million and R$ 900,000.00, because this was the value allocated to urban drainage.
>
> The money left was available for solid waste only; there was no limit to it. All the 55 million could be borrowed for either water supplies or sewerage, but not for urban drainage. We were not entitled to have the money to use in a floodplain; the money was from the Pro-moradia program, directed to land in good condition. It [the proposal] was site and services, then it was a struggle to borrow money for Tucunduba basin from the federal government (Sanitation Engineer, Sep 2000).

This position was even further aggravated by the post 1988 political transfers from federal to local government power. Municipalities became more powerful than ever, without previous qualification in their personnel or change in their organisational structure. Old problems became more acute, such as the lack of integration between different municipal secretariats and agencies, lack of a metropolitan structure of governance, political rivalries between state and municipal governments, weak planning and executive capacity, and imbalance between political and technical authorities.

Yet local government empowerment was an important achievement, since the city was the place where the results of actions at all levels of power could be seen. However, the early 1990s state

governor did not bother about future consequences of his 'support' for invasions. Instead of helping the city to tackle the housing shortage problem, he has given means to the poor to take as much advantage from the invasion process as other agents had. The 'invasion industry' is an example of the effect of a state government policy on the city.

Box 8.9. Early 1990s as the phase of conspicuous political support for invasions

> …at the second electoral turn [of the 1989 elections to state governor, the strategy] was to order the invasion… Elcione [the wife of the state mayor candidate] commanded it; she went everywhere on Belém's periphery. They have done an 'attack' in Belém, because they have lost the first electoral turn… . From that moment onwards invasions became a government policy. The country was facing an economic crisis; there was no money, allocations, nothing, and what position has the power adopted? That!
> … the invasions have happened, supported by FASE's lorries, by COHAB's lorries. COHAB was a big centre for creation of invasions. The invasions did not have anything ideological, of resistance, of nothing, any more. They were a space of which everybody wanted to take advantage, opportunistically (Architect 3 Jan 2000).

The state and local government have seldom united efforts to improve low income housing. Political competition has prevailed over common interest, and it has made harder the struggle against inflexible parameters imposed by federal agencies.

Box 8.10. The struggle against federal agencies' technical parameters

> The parameters are in the engineer's mind, the chief of inspectors. But why? The criteria are obscure; there is a black box. In the assessment of the only source of funding, the Federal Secretariat for Urban Development, the SEDU, there was another vision. I think that the state government through COHAB should have taken advantage of conflict between CEF and SEDU relating to these issues. COHAB became drained, fighting with CEF, fighting with technicians who insisted on streets seven meters wide, or that there was no money otherwise (pilot study interview: Architect 3, Jan 2000).

This has contributed to the low esteem in which city technicians are held, either as local or as state personnel. They have had many more constraints upon them than opportunities to develop suitable upgrade solutions. They also gradually became 'disposable' from the politicians' point of view; better wages (paid to local government employees) today still depends on political influence, and the distribution of investment is led by political interests. To the present time, the city hall offices are still not integrated, and also lack interdisciplinarity and continuity of aims.

Box 8.11. Different approaches to the same project

> …at the beginning, the project was designed by university personnel [in 1997/1998]. Most of the people were roads and soil specialists and there was a hydraulic engineer who has designed the canal. But we [municipal personnel] have started to think that the project was too expensive. Moreover, the canal would be landfilled. We became very worried and have asked for a review, but it was not possible to question too much, because we needed to have the loan approved. We left the project as it was, to change it later, to improve environmental quality and reduce costs. Every time we have questioned the project, the designers have not agreed with us, and we have decided to change the project within our office…. In the end, we realised that if we had designed the project ourselves, the money paid for it would have paid for many other projects, or would have allowed us to buy equipment; it would have been much cheaper… unfortunately, this understanding does not exist [among higher authorities] (Sanitation Engineer, Set 2000).

Despite the context of over-riding political power, there has always had an effort among technicians to change the usual paradigms by questioning the standards established (plot size, street widths, etc.) by funding agencies, and the internal working conditions of government offices. These technicians are asking for integration and a power balance between city hall offices, for tailored (and cheapest) solutions of upgrading, and more holistic action for provision of engineering solutions, plus programs to generate income and to educate inhabitants to improve environmental conditions. There have been advances, but this is thanks to individual personal rather than to institutional action, and it is dependent on the level of freedom these professionals have when inspecting works.

Box 8.12. Example of isolated individual initiative 1

> As an attempt to prevent too narrow streets [in informal settlements], I went to SEURB [during the early 1980s], to talk to Amaral (who was the inspection department's chief). I said: You know, people complain; today they think it is poor [a street], but tomorrow it may become an avenue with access to a fire engine… Then comes a person to tell me that someone is invading [the public space] but I do not have authority to stop it. We needed to take the administrator to the place. He then called two inspectors and told them to do what I was requesting. I explained everything, and they said: but Sir, this will put an end to our part! I said to them: but you will have to go. They have never reappeared, because they lived on bribes [and invaders do not have money to offer to them] (pilot study interview: Architect 2, Jan 2000).

Box 8.13. Example of isolated individual initiative 2

> [About the project designed by specialists mentioned above] We have thought, what has the Tucunduba River to offer to this region? It has to be navigable; the first proposal had a floodgate. As has Jacare River… Then I thought, how much does a floodgate cost? Four million in Jacare; the floodgate would take all the money! Let's try without it; if we need a floodgate, we can put it in later. Afterwards, we realised that the population was used to floods. Then we thought: why do we not keep it as it is, with different levels? Some houses are too low [that is why they are flooded]; level four is always mentioned as the safety level, but it can be lower, 3.6 m. and this allows lower levels of landfill (fieldwork interview: Sanitation Engineer, Set 2000).

8.2.3.1. Sub–conclusion to ligatures

This section discusses paradigms adopted in agents' actions (other than inhabitants) regarding informally produced spaces. The remarkable point in this discussion is with whom the power lies, and the amount of effort needed to hold it (by those in power) or to change it.

Like other developing countries, Brazil has a tradition of centralisation of power by a minority, initially expressed through big estate properties, and more recently through political and economic power. This plus the imposition of requirements by external funding agencies have favoured the association of official actions with large-scale investment, more to give opportunity to economic development than to spread out the benefits of investment over society. Following this path, official standards adopted in making provision did not compromise with inhabitants' ability to pay; they were based on the best technical choice according to the technological point of view. Such a split between technological and socio-economic aspects reached its highest intensity during the military dictatorship. The failures of this period were meant to be repaired through transfers of power from central to local government, in order to improve participation of society in decision-making. However, after this shift, new manifestations of the old problems came about.

Centralisation is perceived in entitlements, through the emphasis on control rather than on interaction, present in the first generation of plans and laws put into effect in Belém. They were oriented to maintenance of the status quo. The same can be said in relation to low income housing and programmes of macrodrainage. The final users' expectations or capacity to have access to the benefits was usually incompatible with the standards and scale of investments of the formal system. The latter is organised to work with most complex technological solutions, which require higher levels of financial investment and are goal-oriented, while the poorest segments of society would be more benefited by process-oriented actions, able to incorporate empowerment and strengthening human capital by participation in decision-making, understanding aims, improvement of professional knowledge, more readily accomplished on smaller scales of intervention and partnership.

Strengthening of local institutions and restructuring of municipal administration did not follow transfer of responsibilities from the central to the local levels. It empowered municipalities, and favoured the establishment of excessively populist relations and of rivalries between the different levels of government. The time of a term of office became the longest horizon for actions, weakening even more the planning activities and overemphasising political opportunities and politicians' importance. Haste prevents innovation, political interest prevents true decision-making,

rivalries prevent integration of different official offices and agencies, excessive reliance on political solutions transformed technicians and professionals into 'disposable articles'.

Invasions are not an answer to inequality only; they are instruments of a new power. Not of inhabitants, but of those who manipulate inhabitants' needs according to particular interests. At present, professionals are more sensitive to the real requirements of upgrading, but most of the power system's structure (especially at the top) is based on conservative paradigms. Some agents have changed places, but the game is still the same.

8.3. The agents

Trindade (1998) has presented the 1980s as a transitional period in housing struggles. After the political changes, the opening up, and the new Federal Constitution, the movement of resistance against the dictatorship faded, allowing the growth of new leaderships and motivations. In Belém the constraint imposed by the authoritarism pre-1980s was only replaced by the constraints imposed by the impoverishment resulting from the Brazilian economic crisis; income became the main means of access to housing provision before legal rights were consolidated and put into effect (Souza, 1992).

The data gathered in the fieldwork has shown that the agents involved in the invasion process have not varied very much over time. However, differences in agents' roles and intensity of power struggles before and after the 1980s transition decade are conspicuous. Invaders, low-income purchasers, informal developers, landowners and politicians are the most frequent agents in the oldest cases of invasion in Belém, such as in the Santa Casa area. The traditional process of upgrade has introduced as new agents the local, state and federal governments, through their offices and funding agencies. Levels of government have had ambivalent positions, depending on their representatives' orientation (either populist or elitist; either progressive or conservative, etc.); and their personnel's possible positions between the technical and political paradigms.

In the particular case of post1980s invasions, such as in Paracuri and Arthur Bernardes, settlements have grown overnight (Trindade, 1998). These are part of 'the invasion industry', in which the informal developer arose to be an influential actor, who needs to implement many decisions after general research into the possible area to be invaded. Another agent who has thriven in these invasions is the tradesman who sells timber and other building materials, paid for in weekly instalments.

8.3.1. Agents' participation in occupation and consolidation, and their contribution to the inhabitants' life chances

The agents identified were classified according to McGlynn's (1993) proposal of a diagram of power (called powergram), in order to summarise their contribution to the improvement of inhabitants' life chances. Pre-1980s invasions had invaders and informal developers as producers, as the evidence of these settlements' hybrid origin shows. Landowners, the community of inhabitants and politicians are considered suppliers. Landowners have kept land without use in a context of housing shortage for low income families, and are suppliers in a negative sense; the community (organised or not) has funded the initial transformation of the natural environment through local contribution and community labour; and politicians have offered building materials to advance environmental transformation. Invaders, professional invaders and low-income purchasers are the consumers. In a negative perspective local authorities are producers by omission, and federal agencies are funders of invasions also by omission, since what they have not done has made a great contribution to informal occupation (Table 8.2).

Table 8.2. Powergram of pre-1980s invasions.

	Suppliers				Producers			Consumers and individual producers		
	Land - owner	Com-munity (funder)	politician	Official housing programmes	Infor-mal deve-loper	Spatial commu-nity	Local autho-rity	Invad-ers	Pro-invad-ers	Purch-asers
Street pattern	⊙	●	●	⊗	⊙	●	⊗	O	O	O
Blocks	-	●	-	-	⊙	●	-	O	O	O
Plots subdivision & amalgamation	-	●	-	⊗	⊙	●	⊗	O	O	O
Land building use	⊙	O	-	⊗	-	●	⊗	●	O	●
Building form:										
Height/ mass	-	O	-	⊗	-	O	⊗	●	-	●
Orientation to pub. space *	-	O	-	-	-	O	-	●	-	●
Elevations	-	O	-	-	-	O	-	●	-	●
Elements of construction	-	O	-	-	-	O	-	●	-	●

* Location of front door or transition between public and private space

● Power either to initiate or control

⊙ Responsibility, either legislative or contractual

O Interest/ Influence, by argument or participation only

⊗ Responsibility by omission

_ No obvious interest

Landowners of flood plain parcels had kept them as commodities. Private landowners have usually made transitional use of their property (typical of fringe belts), such as for vegetable gardens and small farms, until land parcelling becomes profitable (Mourão, 1987:111-112). Federal institutions

have established large landed estates, foreseeing future expansion, and have not been able to use the whole property up to the time they have been invaded. These patterns of use have made these areas highly interesting to low-income consumers of land. The lack of planning definition of land use has contributed to landowners' responsibility for having their land invaded, due to the prevailing lack of understanding or acceptance of the social function of land before the 1980s, despite the Brazilian tradition of occupation prior to tenure regularisation. As the invaded land was a third party property, local government did not interfere in the invasions. An accord between invaders and landowner was a condition of CODEM intervention to promote legal and physical regularisation.

The invaded property's previous land use has influenced street patterns. Public institutions had usually prompted or caused extensions of nearby streets and attracted facilities and services, while private property developments have waited, and followed land transformations. In both cases existing paths of access were often preserved as streets by invaders. Invaders, organised as a community, have provided minimum access to plots, and organised the street layout. In cases where the land was sold by an informal developer, divided according to a fictitious plan, the community provided further definition of land use for newcomers. They have the power to define limits, and expected from politicians the means to improve street physical conditions through landfill, or even by construction of raised wooden walkways. The result of such a vernacular growth has depended on the levels of omission of local authorities and government programs for housing available to low income families. The earlier the invasions are regularised and receive technical assistance, the more stable is the settlement space. The absence of government action results in a continuous increase of density (of housing and people) and a worsening of the existing precarious infrastructure. However, regularisation is not necessarily followed by further improvements; physical conditions might be stagnant or improve slowly afterwards.

Building form is completely defined by consumers. Each household, according to its inhabitants' needs and affordability, shapes its house size, orientation, elements of construction, etc.. There is a similar influence of the surrounding community on each building, related to sharing knowledge about the most frequently adopted technological and spatial solutions for buildings, resulting in a vernacular production of space. Blocks are usually defined after plot occupation, through creation of 'union streets' between two 'implementation streets'. Blocks become smaller during consolidation stages through subdivision and extension of closed streets (transformed into union streets). This process creates different widths along the same street, depending on existing physical characteristics, and the nature of the space's status (public, semi-public, semi-private). This results in a much more deformed grid than in one formally produced, limiting the possibility of integration between smaller grids and the city by some degree of physical regularisation.

These invasion upgrade episodes have created another powergram (Table 8.3). Landowners and funding agencies are considered suppliers of completed upgrade actions. Landowners took part when there was an agreement about land ownership and the residential land use was definitively settled. The funding agencies have been the most important suppliers; they have had power to establish minimum physical standards (usually street width) as a condition of releasing loans, and the amount of money given by them has conditioned further interference in plot organisation and density patterns.

Table 8.3. Powergram to pre-1980s invasions' upgrade

	Suppliers		Producers				Consumers
	Land owner	Funder	Entre-preneur	Planners	Engineers	Architects	
Street pattern	-	●	●	⊙	⊙	⊙	O
Blocks	-	-	●	-	-	⊙	O
Plots subdivision & amalgamation	-	●	●	⊙	-	⊙	O
Land building use	●	-	-	●	-		O
Building form:							
Height/ mass	-	●	-	⊙	-	O	●
Orientation to public space*	-	-	-	-	-	O	●
Elevations	-	-	-	-	-	O	●
Elements of construction	-	●	●	-	⊙	-	●

* Location of front door or transition between public and private space

● Power either to initiate or control

⊙ Responsibility either legislative or contractual

O Interest/ Influence, by argument or participation only

⊗ Responsibility by omission

_ No obvious interest

Planners, engineers, architects (either government personnel or commissioned by the government) and entrepreneurs are producers. Technicians have technical responsibility for the solutions proposed, although they need to respect funders' parameters. Their interest depends on their area of expertise. Sanitation and transport engineers have been concerned with street pattern only, while planners and architects deal with changes in the built form that may be caused by interventions, which are related to street alignment and housing relocation. All interventions have been planned in accordance with the applicable laws, and zonings previously established by planners. Local government personnel have promoted meetings with the communities, with architects giving basic information about construction solutions suitable to local climatic conditions, and guidance about best options (to allow drainage of rainfall) for building on plots, and social developers explaining the procedures, the rights and obligations inhabitants have. However, this fragmentation of responsibilities has limited final results.

The entrepreneur executes the project. Execution according to specified parameters and quality of building materials are his responsibility. Inhabitants have informed this researcher in interviews that they have in the past seen a company's faults, such as use of drainage pipes with smaller diameters than apparently needed, but had no power to interfere, and have been harmed ever since by poor drainage. Companies are selected according to lowest price, and inspection is the weakest of the public work procedures. Consumers have an interest in the infrastructure but had no power to decide it. But they have kept the power to shape building form. Once upgrades are completed, they refurbish houses, change building materials and typologies, and give a new character to former invaded areas. From this point onwards, these became low income districts, which have gradually attracted new inhabitants.

Post 1980s case studies have been made on private property, as most invasions had been on privately owned land during this period. They had, as suppliers: landowners, building material retailers, politicians and the community. Within the current political context, private landowners' expectations were of receiving some kind of compensation according to the potential which the site could have if officially developed: an always profitable solution, given that sites originally had poor physical conditions, poor access and poor street pattern connections. The building materials retailer, who previously was an agent of secondary importance, found an opportunity to profit from the new system of invasions. He installed his shop at the beginning of the settlement to sell building material, and has been very complicit with politicians or politically-engaged institutions. Politicians gave support to invaders by offering machines, basic technical guidance, safety guarantees and promises of regularisation. The individuals have paid for the building materials to build houses, and contributed their own labour, solidarity and emergency local help to produce the public space in invasions land (Table 8.4).

The informal developer and the community are the main producers. The informal developer arose as a mediator between landowners' and invaders' interests, who acts on behalf of politicians or is complicit with them. This actor (an individual or a small group of people) organises the invasions' spatial aspects by defining the size and quantity of plots. He/she 'enrolls' the precise number of invaders through payment of a toll, acquires information about the legal conditions of the area and about availability of support from those politicians who advocate agreement with invaders' demands. The global decisions about street patterns, blocks and plots, as well as sale of plots, have been taken by the informal developer. The invader who does not pay the informal developer for the plot, and or for material supplied by the tradesman, may be expelled and have his/her plot sold again. Plots in informal developments are not much more affordable to low income people than in some official settlements, but the process is simpler, and does not involve bureaucracy (Trindade, 1997).

Table 8.4. Powergram of post-1980s invasions									
	Suppliers				Producers		Consumers		
	Land-owner	Trades-man	Com-munity	Polit./ gov.	Informal devel.	Com-munity	invader	Pro-invader	purchaser
Street pattern	-	-	●	●	●	O	O	O	O
Blocks	-	-	●	●	-	●	O	O	O
Plots subdivision & amalgamation	-	-	●	●	●	O	O	O	O
Land building use	●	-	-	-	-	-	●	-	●
Building form:									
Height/ mass	-	O	O	-	-	O	●	-	●
Orientation to pub. space*	-	-	O	-	-	O	●	-	●
Elevations	-	-	O	-	-	O	●	-	●
Elements of construction	-	●	O	-	-	O	●	-	●

***** Location of front door or transition between public and private space

● Power either to initiate or control

⊙ Responsibility either legislative or contractual

O Interest/ Influence, by argument or participation only

⊗ Responsibility by omission

_ No obvious interest

As a result of basic technical advice, synchronous production of streets, and availability of instruments to mark streets and plots, the space of new invasions has become more organised. Distance between streets is the sum of two plots' length, creating much narrower blocks than in the city centre at the same stage of development. The initial block size in new invasions is similar to old invasion blocks produced after successive subdivisions of blocks and streets. This reduces the complexity of street layout and reduces the possibility of further plot subdivision. The rationalisation of a late invasion's space is similar to that applied in official settlements.

According to IPPUR/UFRJ/FASE (2001), parcelling increases land value 35 times in Belém. This plus the more straightforward consolidation process inside the expansion area (due to better environmental conditions than in the city centre invasions) explains the bigger proportion of professional invaders among initial consumers than formerly. However, the building form is still highly dependent on inhabitants' appreciation of possibilities and strength of will.

The Paracuri case study area had a particular case of upgrade. The state government bought the land to regularise the settlement, and accessed lines of credit to fund works. Inhabitants did not have to pay, since improvements were related to infrastructure provision. In zoning and parcelling, minimum standards were satisfied; streets were rectified by the relocation of houses (in the middle of the street) built beyond alignments of the site, and services were built by COHAB in the upper area, eastwards of the original settlement. Technicians worked as a team, and had freedom to

establish the procedures and solutions up to the point where their actions did not conflict with political decisions. In Paracuri, the fiscal authority led the entrepreneur. COHAB's inspection engineer had autonomy to order works that had not been programmed, such as improvement of the port used by inhabitants to load clay, since there were idle machines which were paid for on a daily basis, and building materials available to fill the landfill. COHAB's directors did not bother about this, although it was harder for COHAB's personnel to combine efforts with municipal technicians to provide social infrastructure, due to political rivalries (Table 8.5).

Table 8.5. Powergram to post-1980s invasions upgrade

	Suppliers		Producers					Consumers
			Local authorities	Entrepreneur	COHAB Technicians			
	Government	Fed. agency			Planners	Designers	Inspector engineer	Inhabitants
Street pattern		●	⊙	●	⊙	⊙	●	O
Blocks			-	●	⊙	⊙	●	O
Plots subdivision & amalgamation			⊙	●	⊙	⊙	●	O
Land building use	●	●	⊙	-	-	-	-	●
Building form:								
Height/ mass			⊙	-	-	-	-	●
Orientation to pub. space*			-	-	-	-	-	●
Elevations			-	-	-	-	-	●
Elements of construction			-	-	-	-	-	●

* Location of front door or transition between public and private space

● Power either to initiate or control

⊙ Responsibility either legislative or contractual

O Interest/ Influence, by argument or participation only

⊗ Responsibility by omission

_ No obvious interest

There were successes and failures; the plan for vegetation recovery was a success, but the water system created to serve the areas was a failure. The whole experience was an example of what is possible when there is political will to regularise an invaded area. It was not sustainable, since, in the end, the state government (through COHAB) was the only authority responsible for expenditure - to the benefit of landowners, politicians and invaders.

8.3.2. Sub–conclusion to agents

This section discussed the role of agents involved in the process of informal settlement production and upgrade. The political changes which occurred in Brazil had strong impacts on agents' actions, changing original relations of power and raising the importance of those who were involved with leadership in invaded areas, potential political representativeness or any scale of funding.

The initial authoritarian conditions created a complete divide between the formal and the informal sectors, which gave to invaders and informal settlement settlers great power regarding the urban form they were creating. Settlers' 'autonomy' resulted in spatial responsiveness to their needs, even though this responsiveness was limited by environmental constraints, due to their trade-off between location and a site's physical conditions. The action of other agents over time was the condition of achieving consolidation through changes in the original configuration. These began to be incorporated in the production of new informal settlements, and gradually replaced the invasion community by individuals who control the settlements' spatial elements.

The 1980s political opening up favoured changes in the official action for informal settlements; however, the inertia within the official administrative structure regarding upgrade and regularisation has prevented the achievement of fully appropriate solutions to inhabitants' needs. The fragmentation of official actions has led to rapid physical change and has taken for granted the incorporation of these changes by inhabitants into their life-styles. It is easy to understand the imposition of professional perspectives on community problems, due to the lack of focus on social issues, and the manipulation of these problems by politicians, who oversimplify them by either offering quick solutions or working as gatekeepers to funding access.

Diverse upgrade experiences have been encountered in Belém. At one extreme is the macrodrainage of Una basin, consisting in a huge project of infrastructure provision funded by international loans, extremely sophisticated in engineering solutions but detached from the original inhabitants' needs at a final cost of U$200,000,000.00. At another extreme are the 'pilot experiences', or 'works of visibility' (in the political jargon), which consist in isolated actions usually unable to benefit areas' adjacencies; they present higher levels of integration between social and spatial solutions than macrodrainage projects, but are never reproduced or extended to other areas. The former case has strong institutional support, and the latter usually relies on personal will, either of an authority or of a group of technicians. In between are the regularisation of rivers and drainage works, usually disconnected to other similar actions carried out within the same basin.

Within the city's context of scarcity, the amount of investment determines the intensity of post-upgrade gentrification. When upgrades do not fit inhabitants' capacity to adapt to physical changes, they simply express the ambivalent position of government about which segments of society would be more benefited by upgrade actions carried out in informally produced areas.

8.4. Conclusion

This chapter investigates whether and to what extent the action of government and other agents in changing the physical configuration of invasion areas has improved the life chances of inhabitants. The findings of the chapter are summarised as follows (Table 8.6):

Table 8.6. Summary of findings

	Settlement form	Building form
Entitlements	Government policies and laws were biased strongly to segments of society other than the poor. This defined availability of land, and occupation conditions in informal areas	Occupation of flooded land.
Provision	Land delivery system and action of politicians are favourable to invasion. Tenure regularisation is slow but accessible. However, land regularisation does not assure solution of physical problems. Building industry interests have been rewarded by contracts.	Adaptation to site's precariousness and lack of physical infrastructure.
Ligatures	Shift in official view regarding settlements, from temporary to abnormal. Struggle against standards too demanding for low income inhabitants' needs. Attempt to balance technical and social solutions.	Gradual improvement of houses according to achievements in settlement form.

From this evidence and discussions it is possible to answer the research question presented at the beginning of this chapter as follows:

Invaded area inhabitants have been very competent in gradually enhancing their building forms with the resources available; however by themselves they are unable to consolidate the space they have created. They need the action of other agents to achieve improvements in social and physical infrastructure, which have a strong impact on their health, their access to urban facilities, and therefore their life chances.

However, the extent of improvement in life chances achieved by inhabitants through the action of other agents has been dependent on the existing overlaps between different agents' interests. In general terms, government and landowners have delayed improvements in housing for low income people, due to their compromise with economic interests rather than with concern for equitable distribution of benefits. In this context, settlement upgrade has been conditioned either by political will or by location, due to the elite's and local authorities' sensitiveness to changes in land value and to demands on the city transport network.

One reason for this situation is the detachment of upgrade actions from housing policies and the mechanisms of urban development control. Investment is made without considering informal areas' spatial potential for consolidation which would help to meet inhabitants' needs. Isolated actions did

not provide the same degree of change in different spatial contexts. The effect of the regularisation of a river and the building of new streets along a canal built to drain the surrounding area had different impacts on inhabitants' life chances in Santa Casa, Santa Cruz and Tucunduba. The provision of landfill in all case study areas also resulted in different degrees of improvement in inhabitants' life chances, indicating that other variables need to be associated with agents' action, despite the current attention given to political will and the amount of investment.

Investment in isolated settlements in the expansion area, without a plan to provide more links between city centre and periphery and between adjacent settlements, is taking longer to provide necessary social infrastructure than it took in the city centre. Conversely, the attempt to provide schools in an isolated community does not guarantee quality of education, nor the original inhabitants' access to further levels of education. Schools of higher levels are more distant, and access has implications for transport costs.

Recognition of this is hardly ever gained, due to the complexity of interests and variety of agents involved in a regular official intervention in informal settlements. International funders, federal, state and local authorities, landowners, politicians, entrepreneurs and inhabitants are all participants. Investors and funders set their conditions for providing loans, and usually are not committed to social achievement, instead drafting a template for spatial improvements, which is simply reproduced in lower spheres of power. Usually emphasis is given to the quantitative measure of immediate achievements (number of households benefited, number of square metres of works, amount of money invested), rather than to the relationship between the new space created and the inhabitants' need of easy access to sources of income, of transport cost reduction, of being educated and of being integrated into a social network.

Understanding that these relationships are affected by the city's street layout, by the hierarchy of streets within the configuration of a settlement, or by the responsiveness of streets to inhabitant's life style, is still lacking. The influence of agents other than inhabitants in the process of formation of new informal settlements has made recent invasions less resourceful spatially. These settlements are more isolated, and less prone to develop local centrality, and use space more intensively, compromising future alternatives for evolution and /or metamorphosis. Meanwhile, high investment to upgrade originally informal areas in the city centre have also increased pressure on the original inhabitants to give way to better-off social groups, feeding a vicious cycle that works against the poorest. To regard inhabitants as passive receptors of benefits prevents them from using their knowledge in tackling poverty through spatial strategies, of having solutions tailored to their needs, and of optimising the financial resources available to carry on upgrade actions by taking them as partners, with responsibilities and objectives, rather than as victims to be protected or people to be manipulated.

Chapter 9
Final Conclusions

Chapter 9 Final Conclusions

9.1. Introduction

In Chapter 1, the question of what is the contribution to inhabitants' long term prospects, or life chances, of spatial solutions in informal settlements in Belém was posed. Answering this question is important, because about half of Belém is constituted of informally built spaces, as a result of socio-economic inequalities between the wealthiest and poorest segments of society. Despite environmental problems, upgrade of these areas has been considered by the Brazilian government as the most feasible option in tackling low income housing demands. When this research began, there was little understanding of how space affects inhabitants' life chances, and therefore of how spatial attributes might contribute to the maximum retention of original inhabitants. This research has investigated potential and perceived life chances in five case study areas at different stages of consolidation, and the evidence found helps to answer the original question.

This chapter brings together the research findings, outlining them in relation to the aims to which they were addressed, and their implication for present trends. It also discusses limitations of the research, indicates its contribution to knowledge, and outlines topics for further studies.

9.2. Summary of the Research Findings

The research findings are grouped according to the research questions presented in Chapter 1. Each question is answered in one of the empirical chapters, as presented next:

Chapter 6 investigated the question: to what extent do life chances in invaded areas depend on: a) location, b) timescale, c) configuration? This question was answered through comparison of five case study areas (occasionally compared to two formally produced control areas) with different locations, times of origin and present stage of consolidation. The analysis was divided into three parts, addressing the three constitutive elements of life chances. 'Entitlements' were assessed through investigation of street layout potential for accessibility over time, and associated with present inhabitants' physical access to income and education. 'Provision' was investigated through the typology of street layout (according to type of evolution and hierarchy) and its correlation with street potentials for accessibility and physical conditions. 'Ligatures' were investigated through observation of the relationship between inhabitants and the public space of informal areas. A summary of these analyses is presented in Figure 9.1.

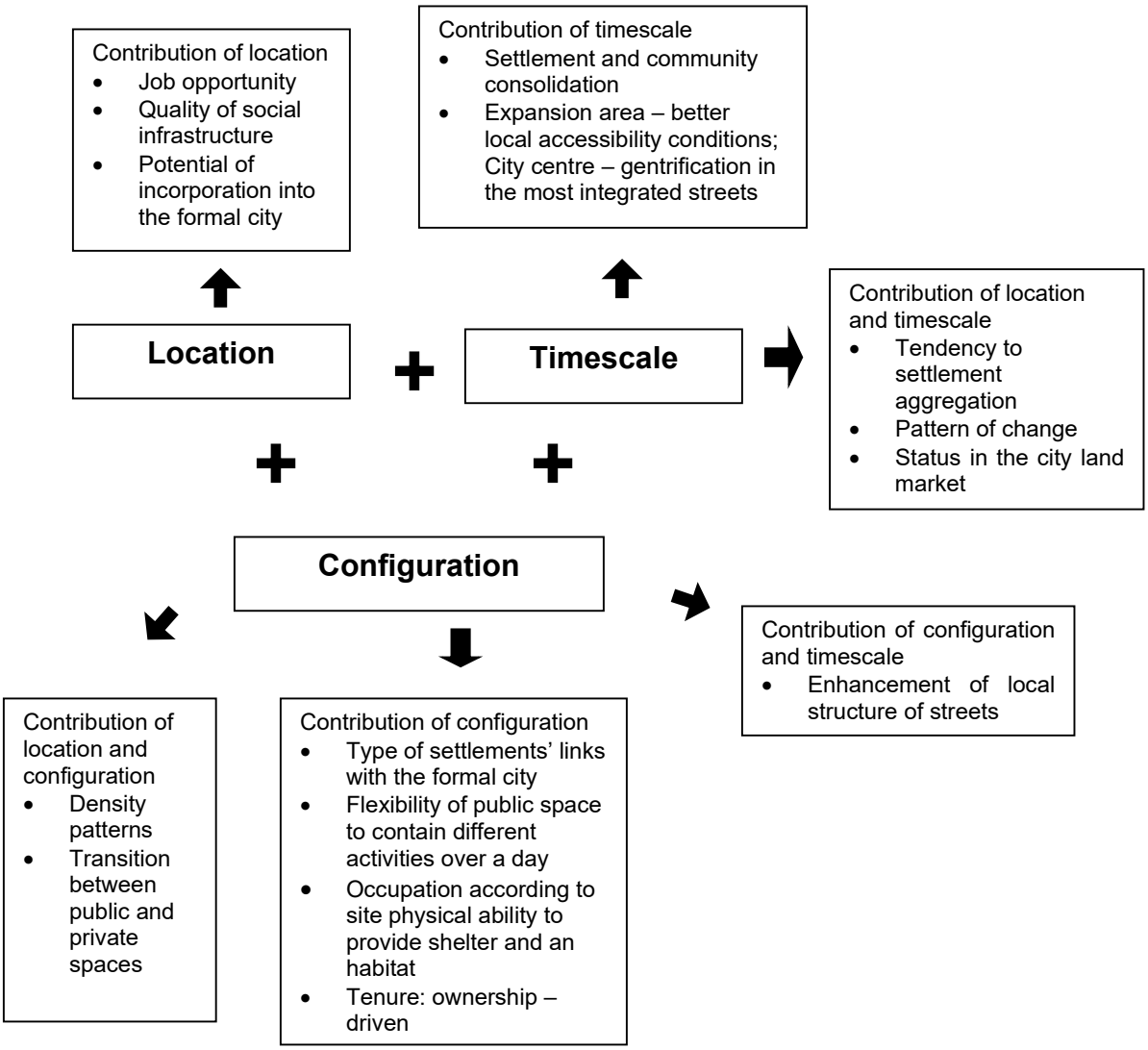


Fig 9.1. Summary of findings of spatial analysis from Chapter 6

Chapter 7 investigated the question: to what extent do inhabitants' perception of life chances vary according to the place in which they live? This question was answered through comparison of case study areas' socio-economic profiles and achievements concerning entitlement, provision and ligatures. Entitlements were investigated through assessing inhabitants' achievements in education, income and housing. Provision was investigated through perceived improvements in street, plot and house. Ligatures were investigated through inhabitants' statements about trade-offs, motivations, values and extension of social networks. A summary is presented in Figure 9.2:

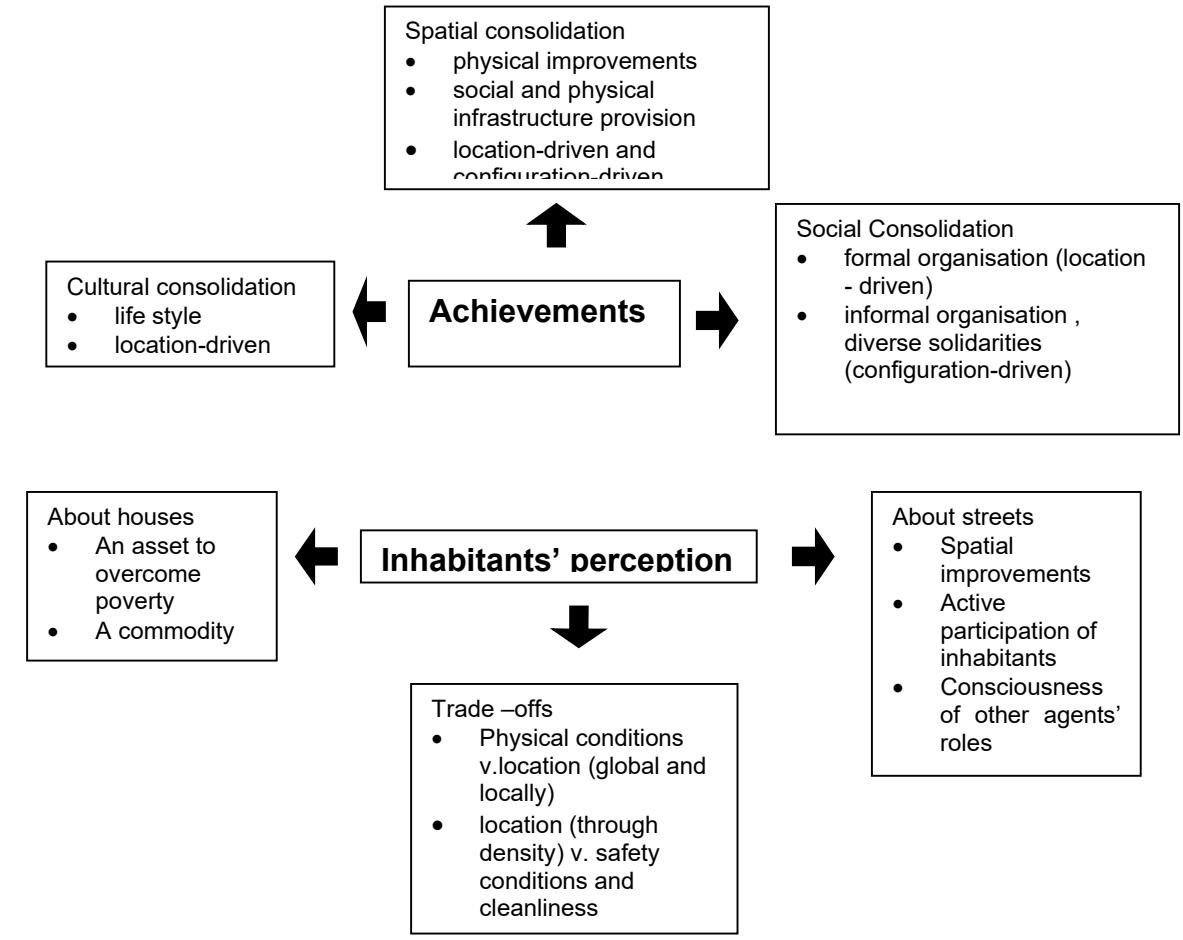


Fig. 9.2. Summary of findings about inhabitant's perceptions and achievements from Chapter 7

Chapter 8 investigated the question: are life chances improved, and if so to what extent, by the action of government and other agents on the physical configuration of invasion areas? This question was answered in four parts. First, the delivery of housing-related laws and policies was associated with the amount of entitlements enjoyed by informal area inhabitants. Second, how housing provision, tenure regularisation and upgrade actions in the city were regarded as provision in case study areas was investigated. Third, the impact of technical and political paradigms in case study areas, described in previous sections, was investigated. Fourth, the agents taking part in the process of informal space production were identified and their contribution to the built form of case study areas was assessed. This analysis is summarised in Figure 9.3:

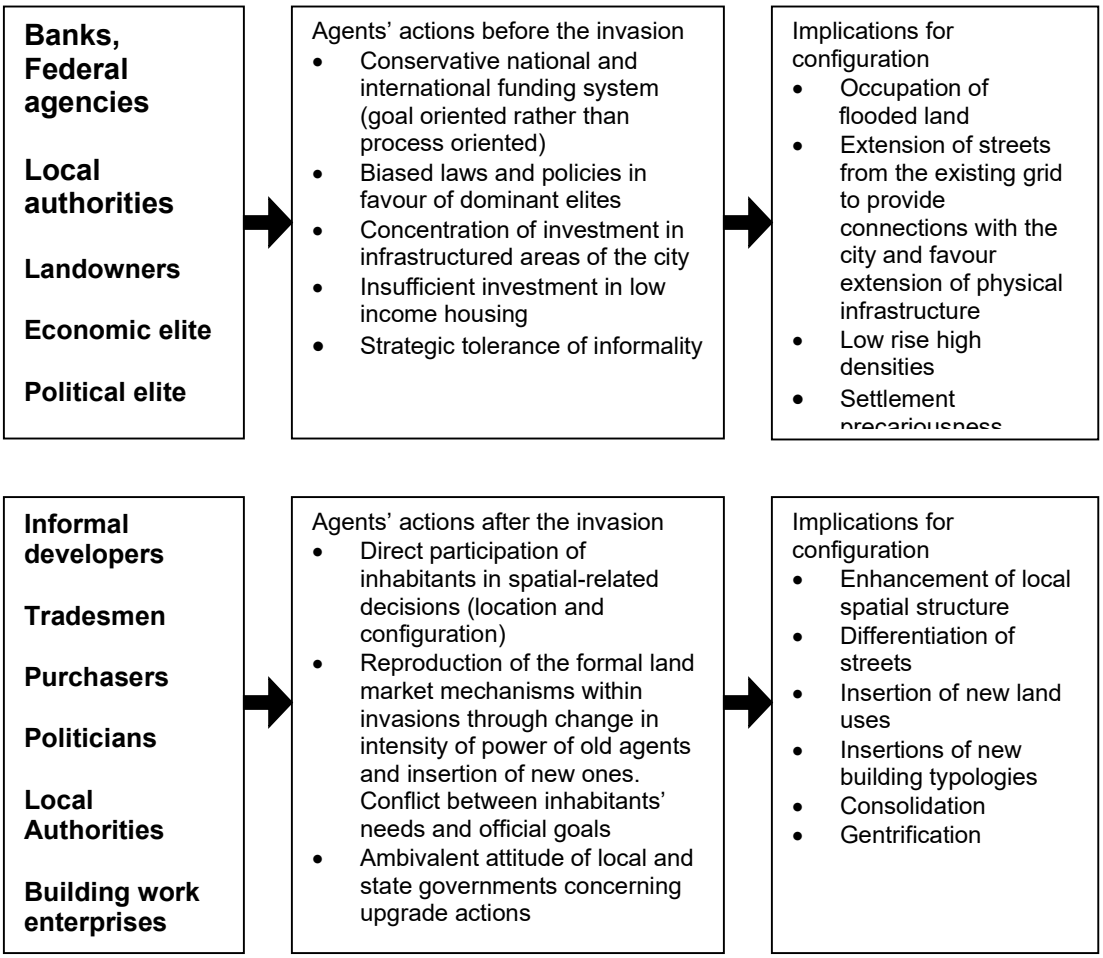


Fig 9.3. Summary of findings about other agents' action on physical configuration of invasion areas from Chapter 8

9.3. Conclusions of the research

The occupation of Belém's *baixadas*, the flooded plains located in the city centre, was a strategy for housing provision by those who were not entitled to formal housing. Entitlements and provision were poor, but in a context of general scarcity there was a potential for access to urban life and to housing. Evidence shows that choices made by invasion areas' long-term inhabitants were reasoned with regard to the type and amount of resources available, and allowed creation of a fragile balance between people and space. Originally, the poor created informal settlements by building a flexible space, carefully positioned in the city, which became extremely compact over time, up to the point which made improvements feasible.

The initial limitations of the poor to entitlements led them to exploit the city's natural environment and their social networks to create provision that would never have been achieved otherwise. By arousing other agents' interests, the poor consolidated the space they created and also found a way to take part in the land market, profiting from commodification. Weak entitlements and provision were enhanced through a strong sense of purpose, consciousness of trade-offs, and strong ties to socio-spatial networks. From a top down perspective, the achievements might appear unremarkable if formal standards are taken as references. However, from a bottom-up perspective, it is possible to see that the poor have done their best to be integrated into the formal city, creating a space extremely responsive to their needs, which if receiving proper improvements, provides inhabitants with dignity and better prospects, and to the city, a long-term asset.

9.3.1. The alternative space of informal settlements

Evolution of syntactic measurements over the last three decades in Tucunduba basin has shown that the street system originally created by inhabitants has reached a stage of balance between a labyrinthine and an excessively regular structure after isolated drainage works, which consisted of building canals and street regularisation. Correlations between syntactic measurements in Paracuri basin are similarly balanced. The aggregation of informal grids in the city centre ended up in creating another city, spatially diverse from the formal one, and with specific characteristics and problems. The isolation of the originally informal settlements in Paracuri has created a suburban area with its inherent benefits and problems (Section 6.3.1).

Despite inhabitants' power to initiate environmental transformation, they did not have the means by themselves either to completely improve the space they had created, or to control density or occupation conditions. Their wisdom seems to lie in their ability to create links with the existing city, to take advantage of alternative means of accessibility and of a flexible and very organised street layout. The infill grids were not created overnight; inhabitant slowly subdivided existing blocks, following everyday shortcuts between important points (e.g.: house and bus stop), preserving the current pedestrian scale and relationships between public and private space. New infill grids are usually well-embedded in the existing streets and are created in specific circumstances, such as after improvements in the original site's physical conditions, and when there is pressure to increase density or to extend a settlement (Sections 6.3.1, 6.3.2 and 6.4.2).

However, definitions of location and creation of spatial configuration is only half the task. The other half is physical improvement and infrastructure provision, which is highly dependent on financial resources (Section 6.4.3). Despite the spatial coherence of the street system, improvements depend on other agents, and when inhabitants are not in charge, improvements usually follow the logic of the land market. Inhabitants accomplish achievements when they obtain material support

from a politician. Otherwise, investment is made in the streets that offer better city-wide accessibility first, and which become differentiated by pavement and sometimes by width (Sections 6.4.2 and 8.3.1).

The inhabitants' perception of their streets' accessibility potential is different from the potential as measured with syntactic tools; for them, all areas are well located, and only Paracuri, which has the best local integration levels of all, is not judged well-located by most inhabitants. Location seems to be a relative quality to inhabitants, varying according to their level of attachment to urban values, despite evidence shown in the Sections 6.3.2 and 7.4.1 about the different potentials for access to income and education and the respective achievements in the centre and in periphery. It seems that among these low income inhabitants also exists a divide between those who appreciate the advantage of being close to the central areas and those who prefer proximity to nature and to a countryside life style (Davison, 1995, quoted in Burton, 1997:195). This being so, due to financial constraints, the attempt to preserve both options is common, as in the Tucunduba case study area. It is located in the city centre (close to sources of jobs), but is quite segregated and close to a river, where most migrants from the countryside prefer to live.

The perception of integration and segregation varies with the intensity of movement in the edges. Arthur Bernardes, despite all its disadvantages, presents more noticeable commercial activity than Paracuri, due to its location, facing a road. Commerce and services in Santa Casa benefit from proximity to a big commercial area and from the intense flow of pedestrians towards the market. In Santa Cruz, the shorter preferred streets are a better location for commercial activities. In the Tucunduba case study area, intensity and type of commercial activity vary according to depth and main means of access (the river is the preferred location for activities that benefit from small ports). High densities are a second factor favouring occurrence of street vending, shops and workshops on the busiest streets, even if during only a certain period of the day (Sections 6.5.3, 6.4.2 and 7.3.).

Changes in street status or physical conditions in the street system strongly affect inhabitants. Better pavement and drainage might turn a previously regular street into a leisure place, as happened in Santa Cruz, despite the occasional presence of buses and vehicles, due to the scarcity of other open places (Section 7.3). Transformation in street physical conditions also means easier access for transport and waste collection, gradual improvement of original houses and gentrification. Gentrification indicates that the process of invasion is going to start again elsewhere (if present economic, political and administrative conditions are maintained) (Section 7.4.2).

As much as the formal city, the informally created city begs for regulation to achieve advisable health and safety standards, and to empower inhabitants to overcome poverty; this formal

regulation means insertion of upgrade actions into broader housing policies and effective action by qualified personnel. There is a lot of work for engineers, planners and architects, as much as for social developers, to properly target the inhabitants' needs and maintain their existing assets (Sections 6.4.3, 8.2.1, 8.2.2 and 8.2.3).

Inhabitants need tailored solutions; it is not advisable to standardise upgrade actions in Belém, given the requirements for different choices and locations. Technical assistance is required to either provide or enhance piped water provision, sewage solutions, plot drainage, waste collection and to guide plot occupation. Streets are the only common spaces available, and a resource to be used by of communities as much as a benefit for the improvement of the city-wide street system, considering the needs of different ages and the timescale of previous improvements (Sections 6.5.3 and 7.4.3). Inhabitants settled in the most consolidated areas no longer want other layers of street landfill; they want streets designed for their needs, especially for children's safety. The creation of mechanisms to increase vegetation coverage and to assure vegetation maintenance are crucial to enhance spatial responsiveness to the existing climatic conditions. Besides this, solutions of partnership between inhabitants and government are required to guarantee suitable standards and affordability for any intervention (Sections 7.4.2 and 7.4.3).

9.3.2. Where life chances are enhanced

Above all, the city centre might offer better entitlements and the expansion area might offer better provision (taking the differences of stage of consolidation and original environmental conditions into account). But all this is relative, depending on the concept inhabitants have of urban life. To identify the ligatures that give sense to inhabitants' choices is extremely important, in order to understand how they cope with their disadvantages (Sections 6.3.2, 6.4.2, 7.4.1 and 7.4.2).

Different spatial solutions correspond to different stages of inhabitants' integration into the city culture. In case study areas where urban life has usually gone on longer (Santa Casa and Santa Cruz), participation in the formal economy is more usual and the number of schooling years is higher. In these areas, bigger households are not as segregated as in the expansion area, indicating that more inhabitants in the households are workers. This can be observed on the streets – there are as many ways to earn money through vending and services provision as the space permits. Workshops, shops, stalls, kiosks, delivery of goods, building works, food preparation, hair and skin care, sewing, etc., are among the many options available to complement household income (Sections 6.5.3 and 7.4.1).

The enhancement of local integration through upgrade has favoured these alternatives, as much the present density levels. But the existence of inhabitants who have regular access to income is an

important guarantee of the availability of money, earned outside the settlement, to be spent internally, as found by Hillier *et al.* (2000) in Santiago's settlements. The evidence showed that the streets located in the Tucunduba basin, with intermediate levels of local integration (between 3rd and 5th deciles) have received successive arrivals, while the most segregated streets mainly had pre-1985 and post-1998 arrivals. The most segregated streets are those in worst physical conditions, and the narrowest ones. This indicates that gentrification and increase in density are happening; possibly better-off newcomers are settling in the most integrated locations and poor people who need to live close to the city centre are settling in the most segregated locations (Sections 6.3.2, 7.3 and 7.4.1).

Gentrification follows improvements in accessibility and infrastructure, usually achieved through drainage and pavement. Increase in density follows available spaces and low prices. There seems to be an optimal synchronicity between the two processes, to enhance the poorest 's life chances. It might be a combination of minimum improvements to attract the better-off who are able to earn money outside the settlement, and of maximum provision in order to enable the poorest to either stay or arrive in the area, benefiting from space to build a livelihood. This gives equal opportunities to different socio-economic segments and includes the previously excluded poor in urban life. If this happens, the poorest also have more opportunity to access social infrastructure (schools and health services) (Sections 6.3.2, 6.5.3, 7.4.1 and 7.4.3).

In the expansion area, the Paracuri case study area is inhabited by a majority of people born in Belém, but who previously lived in other districts. One quarter of the surveyed inhabitants work in the formal sector, and another quarter is self employed. Prospects of access to education and income are lower than in the city centre, but 60% of the households are newcomers and in 32% of these cases there is work at home. Paracuri was upgraded during the early 1990s; however, the system of water supply provided has failed, and water is provided by wells. Nevertheless, physical regularisation was done, with street drainage and landfill; vegetation was preserved and enhanced, and tenure regularisation was initiated (Sections 7.3, 7.4.1, 8.2.2.4 and 8.2.3).

There seems to be a different life style prevailing in Paracuri from those observed in the city centre. In the Paracuri case study area, the population values lower density, the natural landscape and makes a trade-off with location. This might be explained by the existence of a local economic activity, the pottery, in the area. The river provides the raw material and transports the handcraft to sales points. The industries nearby were another source of jobs, but now in decline; family shops seem to be the new alternative business in the area. The shops are located in front of the houses; usually the whole family works in the shop, and is better-off in relation to other inhabitants. Here gentrification was more intense than increase in density after upgrade, indicating that those who

could afford the suburban life style have settled there more easily than the poorest (Sections 6.3.2 and 7.4.2).

Arthur Bernardes settlements are new and very precarious. However, the settlements are strung along a road where the existing commercial activities serve inhabitants and outsiders. The shops and workshops were established before the invasion, indicating that the poorest were attracted by the same mechanism that attracts the poor to most segregated areas of Tucunduba basin (Sections 6.3.2, 6.4.1 and 6.4.2).

Tucunduba has half of its populations composed of migrants, and has gradually been upgraded during the last years. The west edge was improved first, through street pavement and regularisation, favouring the establishment of an open market and some shops. The east edge is the river, where the poorest used to live. The upgrade programmed for the river banks gave priority to river navigability, but is replacing inhabitants living on the river banks and their particular ports by a road and two ports to be used by the community. Local research has shown that the process of gentrification is already on course, targeting the most integrated streets (Oliveira *et al.,* no date). Further, the official proposal aims to enhance tourism-related activities on the river banks, which hardly suits inhabitants' needs. Tucunduba inhabitants are the most attached to rural life styles, but cannot afford life in more distant areas. They are often unskilled by urban standards, and try to raise plants and animals on a tiny plot and to benefit from schools and hospitals nearby. Tucunduba demands even more attention to the timing of spatial improvements and the poorest inhabitants's, spatial requirements (Sections 7.3 and 8.2.2.4).

Another differential in inhabitants' motivations is their personal orientation either as 'aspirers' or 'conformers', to adapt Hanson's (2000) categories to identify social classes. The aspirers desire to achieve higher social status helps them to adapt their livelihoods and life-style to new spatial characteristics (they are looking forward to improvements in infrastructure, cleanliness, safety, etc.). It is not the same with conformers, who do not mind very much about living in a precarious environment and have more difficulty in absorbing new patterns of behaviour. The latter accept the alternative of selling their plot and transferring themselves either to the countryside or to another invasion, restarting the process. These people might be the most disadvantaged: those who lack confidence, or are in less stable households. They are the first affected by upgrade actions carried out by inappropriate standards, and which have little concern with social development (Sections 6.5.2 and 7.3).

9.3.3. Implications of government and other agents' actions on configuration of invasion areas

In a developing country context, the market economy is regulated by conditions of provision against prevailing scarcity (Crooke, 1981 cited in Payne, 1984:5; Gonzales, 1985). Any physical improvement creates a differential of value that increases competition between settlements and favours gentrification. Even though low income inhabitants have learned how to benefit from this process, they are always disadvantaged in relation to upper income groups, who can easily outbid the poor and actually benefit from improvements (Payne,1984).

The most important reasons for this are: the inadequacy of housing policies; the lack of connection of upgrade actions with housing policies, existence of political problems created by rivalries between different levels of government, fragmentation of municipal action in the built space, and imbalance and lack of communication between municipal offices and secretariats. Within this context, spatial configuration is usually taken for granted.

Plans and laws focus a great deal of attention on streets as part of the city transport system and on infrastructure requirements of land use. The relationships between the basic elements of built form (street, block, plot, building) are not considered, and even less importance is given to the relationship between built form and inhabitants' use of space. This approach privileges the global structure of the city and a top down approach, which favours the interests of those better represented in circles of power (such as landowners, big building works enterprises, upper income groups demanding a faster transport system, etc.) (Sections 8.2.1 and 8.2.2).

The historic consolidation of building typologies, land use patterns and infrastructure provision in the formal areas, and the particular integration of street layout in the city centre, as evaluated by Lima (2000), compensates for the lack of concern with configuration by government agents. Interventions in the informal areas, however, cannot rely on historical accumulation of amenities and are more vulnerable to unilateral interventions in the public space (e.g.: transport oriented interventions). As space in these areas is a very important asset to inhabitants, and a setting for multiple superimposed activities (housing, leisure, work, socialisation, etc.) more care is essential during spatial interventions to empower inhabitants rather than to undermine them (Sections 6.5.3 and 7.4.3).

Upgrade actions in Belém have been developed to reach targets according to political demand, rather than to follow long-term policies. Deadlines and quantitative results have been far more important than the outcome of such actions on inhabitant's lives, showing a self-interested attitude

in elected politicians, always most committed to their own maintenance in power (Sections 8.2.2.4 and 8.2.3).

In cases in which housing replacement was needed, due to street regularisation or density control, it is more usual to settle displaced inhabitants in official settlements further way from the original settlement – in the expansion area, with increased costs to both parties. New masonry houses cannot compensate for the new disadvantaged location and the absence of the social mixture which enhances jobs opportunities in the official settlements. This resettlement strategy has proven to be financially unsustainable for both the poor and the government (Section 8.2.2).

It has been always easier for state and local governments to embrace objectives related to the achievement of distinction in the worldly order, than to offer choices able to compensate for structural disadvantages to low income people. The aim to express progress and promote development through strengthening the building industry in the past is comparable to the attempt to adapt the informally occupied river banks to touristic activities. These mixed objectives have led to more expensive, but more visible, housing and upgrade solutions, and are not committed to meeting inhabitants' requirements (Section 8.2.2).

This calls for a noticeable improvement in government interventions in informal settlement space, through the implementation of all compensatory instruments available to ZEIS, the establishment of effective means for citizen (not seen only as electors) participation in decision-making, and a balance between political and technical power. Populist schemes that fragment resources and compromise the extension of low income inhabitants' sphere of actions should be replaced by carefully defined partnerships, so that costs of interventions could be more realistic, and roles of agents more clearly defined. This would optimise administrative capacity and determine the most appropriate times for carrying out upgrade actions (Sections 8.2.3 and 8.3.1).

If upgrade is to enhance the original inhabitants' life chances and to transform previously informal areas into an asset to the city, extensive adjustments to the present administrative structure are required. Consideration of the fragile relationship between inhabitants and space might not be feasible, given the present large-scale approach of city management and planning. There is an incompatibility between the grain of inhabitants' space and the grain of space considered at all levels of government. This prevents tailored solutions by designs able to incorporate the experience of '*baixadas*' long-term inhabitants in developing spatial strategies to overcome poverty. Given the provision required in informal settlements, previously environmentally problematic areas have the potential to become sustainable, because of the capacity of the poor to recycle products and space, and their ability to live with minimum resources (Sections 8.2.1, 8.2.2 and 8.2.3).

9.4. Limitations of this research and topics for further studies

The theoretical methodology adopted in this research is exploratory, and attempts to provide for architects and urban designers an approach that allows incorporation of inhabitants' use of space into their understanding of spatial processes. It has been shown that only the incorporation of inhabitants' perspectives provide explanations about the reasons why they settled in the 'unhealthy, dirty, ugly and crowded' informal settlements formed in Belém's flood plains, and why when they are uprooted, they restart the same process of informal occupation elsewhere.

Certainly the impact of official policies and procedures on the city cannot be evaluated using an approach focused on inhabitants' choice, because they were designed/ developed according to the concept of social equity and justice defined on a different basis. This is also relevant to environmental judgements and serious sustainability discussions.

The research addresses the spatial dimension of the process of invasion, rather than invasion problem as a whole, and is limited to indicating connections with other aspects of the process, such as local provision of low-income housing, infrastructure upgrade actions and forms of regulation of urban form, and some intra-regional and national socio-economic imbalances.

The parameters considered in observing inhabitants' life prospects were inspired by the basic rights granted by the Brazilian Constitution and by Brazilian laws that provide legal instruments and conditions to implement these constitutional rights. No further comparisons were made between inhabitants settled in informal and in official settlements at similar times and in similar socio economic conditions. The establishment of control areas was defined exclusively in terms of spatial adjacency, because streets were adopted as the main element of morphological analysis.

As an exploratory approach, this research covered only a small part of what the methodological framework allows. Further research should be carried out to investigate:

- Characteristics of plots and blocks, and their relationship with the use inhabitants make of private space and with densities and building typologies;
- Alternative infrastructure technologies that could be incrementally extended and easily incorporated into the spatial solutions wanted by inhabitants of originally flooded areas.
- Differences and similarities between the performance of streets, blocks, plots and density levels in originally informal settlements and official settlements, inhabited by people with similar socio-economic profiles.
- The impact of upgrade (including ownership and physical regularisation) on the land market of Belém.
- The potential that planning instruments and fiscal policies have to cushion upgraded areas in Belém against excessive gentrification.

9.5. Contribution to knowledge

This research was an adventurous project which developed from my reflections and experience as an inhabitant of the formal city of Belém, and as an academic, who has been teaching theories of the city which did not explain or even acknowledge the alternative space of informal settlements. Yet the inhabitants of the informal settlements are part of everyone's daily life in Belém; they are workers in our homes, streets and schools; they are also friends whose fortunes and misfortunes are possible to track over time. Everyday contact with the people who inhabitant the informal settlements was my motivation, as an academic, to find the appropriate theoretical framework to study the alternative space created by them, to understand the choices they make in locating themselves in the city, and to identify the different strategies they develop to survive and prosper in such extreme economic and environmental conditions.

The incorporation of a bottom up approach

In order to address the problem of informal settlements, the theoretical framework devised in this research was drawn from different fields of knowledge to build a bottom-up approach able to incorporate elements other than those traditionally associated with provision (i.e.: land tenure conditions, environment problems, urban growth) into the analysis of the space of informal settlements. Fist of all, the adoption of the Darhendorf's definition of life chances crystallised initial ideas into a more precise understanding of what individual long-term prospects are, and provided the theoretical framework required to make explicit different aspects of informal settlements.

This research therefore added a spatial interpretation to Darhendorf's concept of life chances; this was able to add the understanding of the potential delivered by space to the enhancement of low income inhabitants' prospects, and the perception of these inhabitants of this potential, to the usual restricted investigations of informal settlements. This spatial interpretation was more precisely addressed to the specificities of the low-income inhabitants of informal settlements through also reviewing the contribution of studies on livelihoods and poverty. The result of these approaches in combination successfully fulfilled the aim of producing an approach which adopted the perspective of inhabitants, and unveiled the poor's spatial strategies in dealing with space to enhance their life chances.

An alternative methodology able to account for different special scales

By adopting the inhabitants' perspective, and incorporating a fine grain spatial investigation of the informally produced space, it was possible to offer an alternative to the mainstream approaches adopted in Brazil to the informal settlement problem, mostly based on Marxist theories, which have stressed the importance of location as a key variable in the context of scarcity (of land, services and

infrastructure provision), and in which the importance of urban form configuration has not been accounted for.

To reach this ambition, this research benefited from advances in computer technology to integrate social and spatial data and better interpret the data gathered from morphological and syntactic analysis to provide evidence about the importance of space as a resource for low income inhabitants. The findings confirmed the hypothesis that location and configuration have equal importance, as global and local spatial dimensions, to the consolidation of informally produced spaces. These variables, either combined or in isolation, strongly affect access of informal settlement inhabitants to income and opportunities, while the timescale variable unveils the trade-off made by low-income inhabitants between location and a site's physical conditions. It also incorporates the actions of inhabitants and other agents over time in the production of configurations which express different stages of the consolidation process.

Combination of different techniques of spatial analysis

The existence of a broad theoretical framework made possible the selection and combination of techniques of spatial analysis developed within the fields of architecture, geography and planning in an exploratory way. This provided triangulation and increased the interpretability of the empirical data. The superimposition of morphological and syntactic tools of analysis made spatial analysis easier and quicker and led to findings that would be difficult to reach by a unilateral approach (i.e.: the identification of different gradients of accessibility within the street layout).

Much evidence was shown of the impact of different arrangements of streets (either a deformed grid or a more linear structure) on the case studies investigated, in particular on their rhythm of consolidation. These were associated with the street layout potential of being embedded in the existing grid, or of amalgamation with other settlements. It was also possible to observe differences in the arrangements of informal settlements created in different decades which indicated that like plots and buildings, even whole might evolve as identifiable types, depending on the factors and agents taking part in their production.

Methodological replicability

It is possible to say that the methodology created in this thesis was successfully applied to the context of Belém. Nevertheless, as all the variables incorporated in its development belong to the universe of any developing country city facing similar problems of integration of informal settlements to the formal city, the application of this methodology to other cities may provide useful evidence about informal settlements and their inhabitants' strategies to overcome poverty.

If this possibility is confirmed, this thesis will have provided a valuable tool to policy-makers to tackle the identified mismatch between inhabitants' spatial needs and government and funding agencies' understanding of these needs. At present the upgrade solutions that would satisfy inhabitants' needs (such as for health, affordability, and social interaction) are often considered 'substandard' in terms of ideal technical requirements (usually based on the formal city reality).

Although the design of interventions comes at the end of a much larger process that involves international and national funding, national and local government, and different agents and interests, knowledge of the implications of these interventions on space, and of alternatives that would better suit local inhabitants' needs, must be a first step in changing the solutions imposed at higher levels of decision-making. Changes seldom occur in the lower links of the chain, if funding agencies and central governments do not establish policies aiming at inhabitant-friendly solutions.

A final contribution

Finally this research has shown, once again, that low-income inhabitants do their best to integrate themselves to the formal city and to overcome poverty; however there is need for careful timing between inhabitants' initiatives and the intervention of other agents, to facilitate the consolidation of the informally produced space. When support takes too long to occur, the experience of other Brazilian cities, such as Rio de Janeiro, has shown that the informality become an attraction to criminality, undermining the hard and persistent effort of thousands, and their hopes that their children would have a better life than they had themselves.

The research produce considerable evidence on which to build governments' and funding agencies' changes in criteria and procedures of upgrade. It provides a methodology to assess the subtle balance between society and space in informal areas in response to the inadequacy of standardised solutions, and the need to optimise investment by any sector of government or by the inhabitants themselves.

All the effort put into this research - of the author, supervisors, assistants, interviewees (inhabitants and technicians), will be worthwhile if the information provided here becomes the basis for action to enhance the dignity and better life chances of the poor, who need them most.

Bibliography

Bibliography

Acioly, C. & Davidson, F. (1998) *Densidade Urbana – Um instrumento de planejamento e gestão urbana*. Rio de Janeiro: Maua.

Albers, R. (1998) Learning Democratic Practice: Distributing Government Resources through Popular Participation in Porto Alegre, Brazil. In: Douglas, M. & Friedmann, J. (ed.) *Cities for Citizens*. West Sussex: John Wiley & Sons.

Alcantara (1989) *O Processo de Constituição e Redefinição do Espaco Urbano de Belém – Área do Tucunduba*. Monografia de Especializacao. Belém, UFPA/NAEA/FIPAM VI.

Alves, Joana (1997) *Belém, a Capital das Invasões*. Unpublished Master's Thesis. Belém, PLADES/NAEA/UFPA.

Amis, P. (1995) Making Sense of Urban Poverty. *Environment and Urbanization*, Vol. 7, No. 1, p. 145 – 157.

Arida, A. (1998) Quantum Environments: Urban Design in the Post-Cartesian Paradigm. *Urban Design International*, 3 (3), pp. 141 – 148.

Arthur-Bertrand, Y. (2002) *The Earth from the Air: 365 Days*. London: Thames & Hudson.

Azimzadeh, M. & Klarquist, B. (2001) Metamorphosis and Evolution of Cities – the status of planning and urban design. In: Peponis, J.; Wineman, J. & Bafna, S. (eds.) *Proceedings - Space Syntax 3rd International Symposium*. Atlanta, Georgia Institute of Technology, pp 51.1 – 51.15.

Baker, T. (1999) *Doing Social Research*. Singapore: McGraw Hill College.

Bassett, K and Short, J (1980) *Housing and Residential Structure, Alternative Approaches*. London: Routledge & Kegan Paul.

Batty, M. (1999) A Research Program for Urban Morphology. *Environmental and Planning B*: *Planning and Design*, V. 26, 475 – 476

Batty, M. (2001) Editorial. *Environment and Planning B: Planning and Design*, 2001, Vol. 28, pp. 321 – 326.

Beall, J. (1995) Social Security and Social Networks Among the Urban Poor in Pakistan. *Habitat International*, Vol. 19, No. 4, pp 427 – 445.

Bentley, I; Alcock, A.; Murrain, P.; McGlynn, S.; and Smith, G. (1985) *Responsive Environments*: *A Manual for Designers*. Oxford: Butterworth – Heinemann.

Berg, B. (2001) *Qualitative Research Methods for the Social Sciences*. Boston: Allyn & Bacon, pp 211- 267.

Berquó, E. (2001) Evolucão Demográfica. In: Sachs, I., Wilheim, J & Pinheiro, P. .*Brasil Um Século de Transformacões*. São Paulo: Companhia das Letras, pp. 14 – 37.

Bhatt, V. & Scriver, P. (1990) *Contemporary Indian Architecture after the Masters*. Ahmedabad: Mapin Publishing, pp 89 – 103.

Bicca, P. (1984) *Arquiteto – a máscara e a face*. São Paulo: Projeto.

Bicca, P. (1985) Brasília: Mitos e Realidades. In: Paviani, A. (ed.) *Brasília Ideologia e Realidade em Questão*. São Paulo: Projeto, pp. 101 – 134.

Bhatt, V. & Scriver, P. (1999) *After the Masters, Contemporary Indian Architecture*. Ahmedabad: Mapin Publishing, pp 89 – 103.

Brand, S. (1994) *How Buildings Learn*. London: Union Books, p. 2 –22.
Browder, J. and Godfrey, B. (1997) *Rainforest Cities Urbanization, Development, and Globalization of Brazilian Amazon*. New York: Columbia University Press.

Brown, L. (ed.) (1993) *The New Shorter Oxford Dictionary*. Oxford: Clarendon Press.

Bulmer, M. (1983) Sampling. In Bulmer, M. & Warwick, D. (ed) *Social Research in Developing Countries.* London: Jonh Wiley & Sons, p. 91 – 99.

Burgess, R. (1985) Problems in the Classification of Low-income Neighbourhoods in Latin America. *Third World Planning Review*, v. 7, n. 4, pp 287-306.

Burgess, R. (2000) The Compact City Debate: A Global Perspective. In: Jenks, M. & Burgess, R. (ed.) *Compact Cities: Sustainable Urban Forms for Developing Countries*. London and New York: Spon: 9 – 24.

Burgess, R., Carmona, M. & Kolstee, T. (1997a) Cities, the State and the Market. In: Burgess, R., Carmona, M. & Kolstee, T. (eds.) *The Challenge of Sustainable Cities*. London: Zed Books, pp 3-14.

Burgess, R., Carmona, M. & Kolstee, T. (1997b) Contemporary Macroeconomic Strategies and Urban Policies in Developing Countries: A Critical Review. In: Burgess, R., Carmona, M. & Kolstee, T. (eds.) *The Challenge of Sustainable Cities*. London: Zed Books, pp 18 - 31.

Burgess, R., Carmona, M. & Kolstee, T. (1997c) Contemporary Urban Environmental Strategies and Policies in Developing Countries: A Critical Review. In: Burgess, R., Carmona, M. & Kolstee, T. (eds.) *The Challenge of Sustainable Cities*. London: Zed Books, pp 65 - 88.

Burton, E (1997) *The Compact City: Just or Just Compact*. Unpublished PhD thesis. Oxford: Oxford Brookes University.

Cabral, Cicerino (1995) *Clima e Morfologia Urbana em Belém*. Belém, UFPA.

Calliandro, V. (1991) Street Form and Use: A Survey of Principal American Street Environments. In: Stanford, A. (ed.) *On Streets*. Cambridge, Massachesetts and London: MIT Press, pp 150 – 186.

Calvino, I. (1997) *Invisible Cities.* Translated by William Wever. London: Vintage.

Cannigia G. & Maffei, L. (1995) *Tipologia de la Edificacion, Estructura del Espacio Antropico*. Madrid: Celeste Ediciones S. A..

Cardoso, A. & Rodrigues, A. (1990). Uma Janela para o Reduto. Undergraduate thesis, Belém: UFPa.

Cardoso, A. (1994) *Subisídios para revitalização do bairro do Reduto - Belém/PA*. Brasília, FAU/UnB, Unpublished Master's Thesis.

Castells, M. (2000) Urban Sustainability in the Informational Age. *City*, Vol. 4, No. 1, pp. 118 – 122.

Castro, F. (1994) *A Cidade Sebastiana – era da borracha, memória e melancolia numa capital da periferia da modernidade*. Brasília: Universidade de Brasília, Unpublished Master'sThesis.

CELPA - Centrais Elétricas do Estado do Pará (1998) *Map of Belém*. Computer file.

Chambers, R. (1995) Poverty and Livelihoods: whose reality counts? *Environment and Urbanization*, Vol. 7, No. 1, pp 173 – 204.

Chaves, M. & Baía, R. (2000). *Qualidade da água da invasão 'Riacho Doce'.* Belém. UFPA/CT/DEQ. Unpublished Undergraduate Thesis.

Choguill, C. & Choguill, M. (1996) Towards Sustainable Infrastructure for Low-Income Communities. In: Pugh, C. (ed.) *Sustainability, the Environment and Urbanization*. London: Earthscan, pp 83 – 101.

Choguill, C. (1995) The Future of Planned Urban Development in Third World: New Directions. In: Aldrich, B. & Sandhu, R. (eds.) *Housing the Urban Poor*. London: Zed Books, 403-414.

CODEM - Companhia de Desenvolvimento e Administração da Área Metropolitana de Belém (1977) *Aerial Photographs and Plans of Belém*. (photocopies)

CODEM - Companhia de Desenvolvimento e Administração da Área Metropolitana de Belém (1986) *Aerial Photographs of Belém*. (photocopies)

CODEM - Companhia de Desenvolvimento e Administração da Área Metropolitana de Belém (1998) *Aerial Photographs of Belém*. (cd-rom)

Correa, C. (1985) *The New Landscape*. Bombay: Book Society of India.

Cozen, M. R. G. (1969) *Alnwick, Northumberland. A Study in Town Plan Analysis*. Oxford, Institute of British Geographers.

Curtis, W. (1998) *Balkrishna Doshi: An Architecture for India*. New York: Rizzoli International.

Dahrendorf, R. (1979) *Life Chances*. London: Weidenfeld and Nicolson.

Dahrendorf, R. (1988) *The Modern Social Conflict: An Essay on the Politics of Liberty*. London: Weidenfeld and Nicolson.

Dos Santos, C. N. (1980) Velhas Novidades nos Modos de Urbanização Brasileiros. In: Valladares, Lícia do Prado (ed.) *Habitação em Questão*. Rio de Janeiro: Zahar.

Dos Santos, C. N. (1984) Apresentação. In: Turkienickz, B. & Batista, G. (ed.) *I Seminário sobre Desenho Urbano no Brasil*. Brasília: DA/IA/UnB, pp. 6-7.

Dos Santos, C. N. (1988) *A Cidade como um Jogo de Cartas*. Niterói: Universidade Federal Fluminense: EDUFF; São Paulo: Projeto.

Dos Santos, Carlos N. & Vogel, A. (1981). *Quando a Rua vira Casa. A Apropriação de Espaços de Uso Coletivo en um Centro de Bairro*. Rio de Janeiro: IBAM/FINEP.

Drakakis- Smith, D. (2000) *The Third World City*. London: Routledge, second edition.

Dupas, G. (2000) Os grandes desafios da economia globalizada. In: Sachs, I., Wilheim, J & Pinheiro, P. .*Brasil Um Século de Transformacões*. São Paulo: Companhia das Letras, pp. 430 – 455.

Elkin, T; McLaren, D with Hillman, M (1991) *Reviving the City*: *Towards Sustainable Urban Development*. London: Friends of the Earth.

Fekete, J. (1988) Introductory Notes for a Postmodern Agenda. In Fekete, J. (ed.) *Life After Postmodernism.- essays on Value and Culture*. London, Macmillan, pp I – XIX.

Fernandes, E. (2001) Perspectivas para a renovação das políticas de legalização de favelas no Brasil. *Cadernos IPUR*. Rio de Janeiro, Ano XV, No. 1, p. 9 – 38.

Ferreira, A. (1999). *Novo Aurélio Século XXI: o Dicionário da Língua Portuguesa*. 3ª ed. revista e ampliada. Rio de Janeiro: Nova Fronteira, 1999.

Ferreira, C. (1995) *Produção do Espaço Urbano e Degradação Ambiental: um estudo sobre a várzea do igarapé do Tucunduba (Belém-PA)*. Dissertação de Mestrado não publicada. USP/ FFLCH/ DG, São Paulo.

Flyvbjerg, B. (1998) Empowering Civil Society: Habermas, Foucault and the Question of Conflict. In Douglass, M. & Friedmann, J. (ed.) *Cities for Citizens*. West Sussex, John Wiley & Sons, pp. 185 – 211.

Ford, L. (2000) *The Spaces Between Buildings*. Baltimore: John Hopkins University Press.

Friedmann, J. And Douglass, M. Editor's Introduction. In: Friemann, J. And Douglass, M. (1998*) Cities for Citizens*. Chicester, John Wiley & Sons.pp 1-6

Ghafur, S. (1997*) Spatial Setting for Homebased Income Generation: the Case of Intermediate-Sized Cities, Bangladesh*. Unpublished PhD thesis. Oxford: Oxford Brookes University.

Gilbert, A. & Guggler, J. (2000). *Cities, Poverty and Development*. Oxford: Oxford University Press, second edition.

Gonzales, S. (1985) A Renda do Solo Urbano: Hipóteses de Explicação de seu Papel na Evolução da Cidade. In: Gonzales, S; Holanda, F.; Kohlsdorf, M. E.; Farret, R*. O Espaço da Cidade – Contribuição à Análise Urbana*. São Paulo: Projeto Editores Associados, pp 91 – 114.

Gray, T. (1991) *Freedom Issues in Political Theory. London*, MacMillan, pp 3 – 83.

Hall, A. (2000) A New Paradigm for Local Development Plans. *Urban Design International*, 5, 123-140.

Hall, P. (1999) *Sustainable Cities or Town Cramming?* London: Town and Country Planning Association.

Hall, P. & Pfeiffer, U. (2000) Urban Future 21. *A Global Agenda for the Twenty-First Century*. London, E&FN Spon, pp 3 – 140.

Hall, P. (1987) Metropolitan Settlements Strategies. In: Rodwin, L. (ed.) *Shelter, Settlements and Development, United Nations*. Boston/London: Allen & Unwin, pp 236 – 259.

Hanson, J. (2000) Urban Transformations: a History of Design Ideas. *Urban Design International* 5, 97 – 122.

Hardoy (1992) Theory and Practice of Urban Planning in Europe, 1850 – 1930: Its Transfer to Latin America. In: Morse, R. & Hardoy, J. (ed.) *Rethinking the Latin American City*. Baltimore and London: John Hopkins University Press.

Hardoy, J (1989). *Squatter Citizen : Life in the Urban Third World*. London: Earthscan.

Hardoy, J. & Satterthwaite, D. (1987) The Legal and Illegal City. In: Rodwin, L.(ed) Rodwin, L. (ed.) *Shelter, Settlements and Development, United Nations*. Boston/London: Allen & Unwin, pp 304 – 338.

Hardoy, J., Mitlin, D. & Satterthwaite, D. (1992) *Environmental Problems in Third World Cities*. London: Earthscan.

Harvey, D. (1973) *Social Justice and the City*. London: Edward Arnold.

Harvey, D. (2000) *Spaces of Hope*. Edinburgh: Edinburgh University Press, pp 73 – 94.

Hereda & Alonso (1996) Política Urbana e melhoria da qualidade de vida em Diadema. In: Bonduki, N. (ed.) *Habitat: as práticas bem sucedidas em habitação, meio ambiente e gestão urbana nas cidades brasileiras*. São Paulo: Studio Nobel, pp. 129 – 144.

Hill, D. (1994) *Citizens for Cities: Urban Policy in the 1990s*. London: Harvester Wheatsheaf, pp 9 – 84.

Hillier, B. & Hanson, J. (1984) *The Social Logic of Space*. Cambridge: Cambridge University Press.

Hillier, B. & Hanson, J. (1998) Space Syntax as a Research Programme. *Urban Morphology* 2 (2), 108 – 110.

Hillier, B (1989) The Architecture of the Urban Object. *Ekistics*. 56, pp. 5-22.

Hillier, B. (1996) *Space is the Machine*. Cambridge, Cambridge University Press.

Hillier, B. (1999) The Hidden Geometry of Deformed Grids: or, Why Space Syntax Works, When it Looks as it Shouldn't. *Environment and Planning B*. 26, 2, pp. 169-191.

Hillier, B., Greene, M. & Desyllas, J. (2000) Self-generated Neighbourhoods: the Role of Urban Form in the Consolidation of Informal Settlements. *Urban Design International*, 5, 61-96.

Holanda, F. (1997) *O Espaço de Exceção* (*Exceptional Space)*. Unpublished PhD Thesis. London, Barttlet School of Graduate Studies. University College London (translated into Portuguese by the author).

IBGE - Instituto Brasileiro de Geografia e Estatística (1992*) Censo Demográfico. Região Metropolitana de Belém*. Rio de Janeiro: IBGE.

IBGE - Instituto Brasileiro de Geografia e Estatística (1999) Pesquisa Nacional por Amostra de Domicílios. – Pará, Região Metropolitana de Belém. Rio de Janeiro, IBGE.

IPEA- Instituto de Pesquisa Econômica Aplicada (1997) Estudo "Gestão do Uso do Solo e Disfunções do Crescimento Urbano". Relatório 3 - Consultores. Brasília, IPEA.

IPEA/DAU - Instituto de Pesquisa Econômica Aplicada / Departamento de Arquitetura e Urbanismo (1997) *Gestão do Uso do Solo e Disfunções do Espaço Urbano. Relatório de Pesquisa*. Belém, UFPA.

IPPUR/ UFRJ/ FASE – Instituto de Pesquisa e Planejamento Urbano e Regional/ Universidade federal do Rio de Janeiro/ Federação de Órgãos para Assistência Social e Educacional (2001) *Cadernos do Programa Habitar Brasil* / BID. Volume 1 - Política Municipal de Habitação Orientações para Formulação e Implementação. Brasília, Secretaria Especial de Desenvolvimento Urbano da Presidência da República.

Jenks, M. (2000) Introduction: Sustainable Urban Form in Developing Countries? In: Jenks, M. & Burgess, R. (ed.) *Compact Cities. Sustainable Urban Forms for Developing Countries*. London and New York: Spon, pp 1 – 6.

JICA - Japan International Co-operation (1991*) The Masterplan Study on Urban Transport in Belém in the Federative Republic of Brazil*. Belém: JICA.

Karimi, K. (2000) Urban Conservation and Spatial Transformation: Preserving the Fragments or Maintaining the 'Spatial Spirit'. *Urban Design International* 5, 221-231.

Kempen, E. (1994) The Dual City and the Poor: Social Polarisation, Social Segregation and Life Chances. *Urban Studies* (31), 995-1015.

Knox, P. & Pinch, S. (2000) *Urban Social Geography, an Introduction*. Essex: Prentice Hall.

Kohlsdorf, M. E. (1985) Breve Histórico do Espaço Urbano como Campo Disciplinar. In: Gonzales, S; Holanda, F.; Kohlsdorf, M. E.; Farret, R. *O Espaço da Cidade – Contribuição à Análise Urbana*. São Paulo: Projeto, pp 15 – 72.

Kowarick, L. (1975) *Capitalismo e Marginalidade na América Latina*. Rio de Janeiro: Paz e Terra.

Kropf, K. (1998) Space is the Machine. Book Reviews, *Urban Morphology*, 2, (1), pp 59 – 60.

Kropf, K. (2001) Conceptions of Change in the Built Environment. *Urban Morphology*, 5 (1), pp 29 – 45.

Kubat, A. (1999) The Morphological History of Istanbul. *Urban Morphology*, 3 (1), 28 – 41.

Lamas, J. (1992) *Morfologia Urbana e Desenho da Cidade*. Lisboa: FCG/JNICT, pp. 185, desenho 2.

Lemos, C. (1979). *Arquitetura Brasileira*. São Paulo: Melhoramentos/ Ed. da Universidade de São Paulo.

Levitas, G. (1991) Anthropology and Sociology of Streets. In: Standford, A. (ed) *On Streets*. Cambridge, Massachusetts and London: MIT Press, pp 150 - 186.

Levy, A. (1999) Urban Morphology and the Problem of the Modern Urban Fabric: Some Questions for Research. *Urban Morphology*, 3 (2), 79 – 85.

Lima, J. (2000) *Regulatory Instruments and UrbanForm: Searching for Social Equity in Belém, Brazil*. Unpublished PhD thesis. Oxford: Oxford Brookes University.

Lima, J. (2001) Housing Policy in Belém Metropolitan Region. Report presented in the Workshop about Belém, National Network of Assessment and Sprawl of Alternative Experiences in Popular Housing. Rio de Janeiro: IPPUR/UFRJ-FASE.

Lynch, K. (1960) *The Image of the City*. Cambridge, Massachusetts, and London: MIT Press.

Madaleno, I. (2000) Urban Agriculture in Belém, Brazil. *Cities*, 17, 1, pp 73 – 77.

Magalhães, C & Nunes, J. (2001) *Regularização Urbanística x Regularização Jurídica: o caso da área das Malvinas*. Belém: II Encontro Internacional 'Democracia, Igualdade e Qualidade de Vida'.

Magalhães, C. (1992) *Space, Politics and Autoconstruction in Two Settlements in Rio: a Comparison Between the Unplanned Morro do Timbau and the Planned Marcílio Dias Self-help Housing Project.* Unpublished PhD thesis. Barttlet School of Architecture and Planning, University College, London.

Maricato, E. (2000) As idéias fora do lugar e o lugar fora das idéias. Planejamento Urbano no Brasil. In Arantes, O; Vainer, C. & Maricato, E. *A Cidade do Pensamento Único*. Petrópolis: Vozes, pp. 121-191.

Marx, M. (1991) *Cidade no Brasil Terra de Quem?* São Paulo: Nobel.

Marzot, N. (1998) The Role of History in Conzen's and Caniggia's Approaches to Urban Design. *Urban Morphology*, 2, 1, 54-55.

Mascaró, J. (1987) *Desenho Urbano e Custos de Urbanização*. Porto Alegre: D.C. Luzzato, pp. 150 – 173.

McGlynn, S. & Samuels, I. (2000) The Funnel, the Sieve and the Template: Towards an Operational Urban Morphology. *Urban Morphology*, 4, pp. 79 – 89.

McGlynn, S. (1993) Reviewing the Rhetoric. In Hayward, R. & McGlynn, S. (ed) *Making Better Places: Urban Design Now*. Betterworth, Oxford.

McGranahan, G. & Satterthwaite, D. (2000) Environmental Health or Ecological Sustainability? Reconciling the Brown and Green Agendas in Urban Development. In: Pugh, C. (ed.) *Sustainable Cities in Developing Countries*. London: Earthscan, pp. 73 – 90.

Mercês, S (ed.) (1997) *Relatório Ambiental da RMB*. Belém: PNDU/IPEA/FADESP/COHAB.

Moreira, D. (2001) Avaliação da Qualidade de Água Distribuída em Belém. Belém: UFPA/CT/DEQ. Unpublished Undergraduate Thesis

Moser, C. (1995) Urban Social Policy and Poverty Reduction. *Environment and Urbanization*, Vol. 7, No. 1, p. 159 – 171.

Moser, C. (1998) The Asset Vulnerability Framework: Reassessing Urban Poverty Reduction Strategies. *World Development*, Vol. 26, No. 1, pp 1-19.

Moudon, A. V. (1997) Urban Morphology as an Emerging Interdisciplinary Field. *Urban Morphology*, 1, pp 3 – 10.

Moudon, A. V.(1992) The Evolution of Twentieth-Century Residential Forms: An American Case Study. In: Whitehand, J. W. R. & Larkham, P. J. (ed) *Urban Landscape: International Perspectives*. London: Routledge.

Mourão, L. (1987) *O Conflito Fundiário Urbano em Belém*. Unpublished Master's Thesis. PLADES/ NAEA/ UFPA, Belém.

Muniz, P. (1904) *Patrimônio dos Conselhos Municipais do Estado do Pará*. Belém: Gov. do Estado do Pará.

Nunan, F & Satterthwaite, D. (1999) *The Urban Environment*. Birmingham: University of Birmingham, International Development Department, Urban Governance, Partnership and Poverty.

Oliveira, R.; Szlafsztein, C.; and Imbiriba Jr., M. (2000) *Caracterização das Bacias Hidrográficas do Distrito Administrativo de Icoaraci (DAICO) e dos Problemas Ambientais associados com o auxílio do Geoprocessamento*. Salvador: V Congresso de Usuários de Geoprocessamento (cd rom).

Oliveira, J & Tavares, M.G.(no date) Renovação Urbana e Gestão Ambiental: Análise de uma Proposta de Intervenção na Bacia do Tucunduba. Relatório de Pesquisa. Belém: Departamento de Geografia/ UFPA.

Paviani, A. (1985) A Metrópole Terciária. In: Paviani, A. (ed.) *Brasília Ideologia e Realidade em Questão*. São Paulo: Projeto, pp. 57 – 80.

Payne, G (1999) Introduction. In: Payne, G. (ed.) *Making Common Ground*. London, ITP. pp 1-16

Payne, G. (1997) *Urban Land Tenure and Property Rights in Developing Countries*. London: ITP/ODA.

Payne, G. (1984) *Low-income Housing in the Developing World*. London: John Wiley & Sons.

Payne, G. (1977) *Urban Housing in the Third World*. London: Leonard Hill/ Boston: Routledge & Kegan Paul.

Peil, M. (1983) Situational Variables. In Bulmer, M. & Warwick, D. (ed) *Social Research in Developing Countries*. London: John Wiley & Sons, p. 71 – 87.

Perdomo, R. & Bolivar, T. (1998) Legal Pluralism in Caracas. In Fernandes, E. & Varley, A. (ed.) *Illegal Cities*. London, Zed Books, pp 123 – 139.

Perlman, J. (1976) *The Myth of Marginality: Urban Poverty and Politics in Rio de Janeiro*. Berkeley: University of California Press.

PMB – Prefeitura Municipal de Belém (1989) *Relatório de 1989/ Secretaria Municipal de Saneamento*. Belém: PMB/SESAN, pp. 63, 73, 84.

PMB – Prefeitura Municipal de Belém (1990) *Relatório de 1990/ Secretaria Municipal de Saneamento*. Belém: PMB/SESAN, pp. 129, 130, 185, 186, 189, 208.

PMB - Prefeitura Municipal de Belém (1999) *Projeto de Urbanização da Bacia do Tucunduba*. Diagnosis, Belém: PMB/SEURB/DEPL.

PMB/ Habitar Brasil/ BID – Prefeitura Municipal de Belém/ Habitat Brasil/ Interamerican Bank of Development (2001). Plano Estratégico Municipal para Assentamentos Subnormais (PEMAS). Belém: Prefeitura Municipal de Belém, cd-rom.

PMB/IBAM - Prefeitura Municipal de Belém e Instituto Brasileiro de Administração Municipal (no date) Formulário de inscrição de prática "Gestão de Rios Urbanos - Urbanização do Igarapé Tucunduba em Belém" a premiação das melhores práticas pela Caixa Econômica Federal do Pará/Guia Dubai/2002. Belém: PMB (computer file).

Prior, D.; Stewart, J. & Walsh, K. (1995) *Citizenship: Rights, Community & Participation*. London: Pitman Publishing, pp 1 – 21.

Pugh, C. (1995) The Role of the World Bank in Housing. In: Aldrich, B. & Sandhu, R. (eds.) *Housing the Urban Poor. Policy and Practice in Developing Countries*. London: Zed Books, pp. 34 – 89.

Rakodi, C. (1995a) Poverty Line or Household Strategies? *Habitat International*, Vol. 19, No. 4, pp 407 – 426.

Rakodi, C. (1995b) The Household Strategies of the Urban Poor: coping with poverty and recession in Gweru, Zimbabwe. *Habitat International*, Vol. 19, No. 4, pp 447 – 471.

Rapoport (1969) *House Form and Culture*. Englewood Cliffs, N.J.: Prentice Hall.

Rodrigues, D. (1979) *Um Estudo sobre Liderança e Conflito*. Unpublished Master's Thesis. Rio de Janeiro, IUPRJ.

Rodríguez, J. & Villa, M. (1996) Demographic Trends in Latin America's Metropolises, 1950 – 1990. In: Gilbert, A. (ed.) *The Mega-City in Latin America*. Tokyo/NY/Paris: United Nations University Press, pp 25 – 52.

Rolnik, R (1997) *A Cidade e a Lei*. São Paulo: Nobel.

Rossi, A. (1982) *The Architecture of the City*. Cambridge, Massachusetts and London: Granham Foundation, pp 29-61.

Rubin, H. & Rubin, J. (1995) *Qualitative Interviewing. The Art of Hearing Data*. London: SAGE.

Salheen, M. & Forsyth, L. (2001) Addressing Distance in the Space Syntax Syntactical Model. *Urban Design International*, 6, 93-110.

Samuels, I. (1985) *Urban Morphology in Design*. Joint Centre for Urban Design. Oxford: Oxford Polytechnic.

Santos, Cláudio (1999) *Políticas Federais de Habitação no Brasil: 1964 – 1998*. Texto para discussão 654. Brasília, IPEA. Web site: www.ipe.gov.br on 8/4/2002.

Sassen, S. (1994) *Cities in a World Economy*. California: Thousand Oaks; London: Pine Forge Press.

Schiller, S. & Evans, J. (2000) Urban Climate and Compact Cities in Developing Countries. In: Jenks, M & Burgess, R. (eds.) *Compact Cities: Sustainable Urban Forms for Developing Countries. London*: Spon, pp. 117 – 126.

SEGEP – Planning and Governance Municipal Secreatariat (2002) Compiled data about Belém, obtained under request. Mimeo.

Sen, A. (2001) *Development as Freedom*. Oxford: Oxford University Press.

Sennet, R. (1977) *The Fall of Public Man*. London/Boston: Faber & Faber.

Silva, Francisco (1982) *História do Brasil: Império e República*. São Paulo: Moderna, Volume 2.

Soja, E. (1980) The Socio-spatial Dialectic. *Annals of the Association of American Geographers*, 70, 2, pp. 207-225.

Soja, E. (2000) *Postmetropolis: Critical Studies of Cities and Regions*. Oxford: Blackwells.

Souza, D (1992) *Intervenção Estatal no Município: o Caso de Belém na Década de 80.* Unpublished Master Thesis. Belém: NAEA/UFPa.

Souza, F. (1998) Perceived Security of Land Tenure and Low-Income Housing Markets in Recife. Unpublished PhD thesis. Oxford: Oxford Brookes University.

Souza, M. (2002) *Mudar a Cidade. Uma introdução Crítica ao Planejamento e à Gestão Urbanos*. Rio de Janeiro: Bertrand Brasil, 25 – 82.

Steele, J. (1998) The Complete Architecture of Balkrishna Doshi. Rethinking Modernism for the Developing Country. London: Thames & Hudson, pp. 114 – 129.

Stonor, T. & Dalton, N. (1990) *Axman Manual*. Revised in 2001 by Laura Vaughan and Chris Stutz. London: UCL (computer file).

Suttles, G. (1968) *The Social Order of the Slum*. Chicago: University Press, pp 6-8; 73-78.

Taschner, S. (1995) Squatter Settlements and Slums in Brazil: Twenty Years of Research and Policy. In: Aldrich, B. & Sandhu, R. (ed.) *Housing the Urban Poor*. Policy & Practice in Developed Countries. London: Zed Books, pp 185-223.

Thery, H. (2001) Retrato Cartográfico e Estatístico. In: Sachs, I.; Wilheim, J. & Pinheiro, P. (eds.) *Brasil Um Século de Transformações*. São Paulo, Companhia das Letras, pp. 394 – 417.

Trindade Jr.,Saint-Clair (1998) . *A Cidade Dispersa.* Unpublished PhD Thesis. São Paulo: USP - Faculdade de Filosofia e Ciências Humanas.

Tuan, Y. (1983) *Espaço e Lugar*. São Paulo: DIFEL.

Turkienicz, B.; Kohlsdorf, G.; Boas, M.; Kohlsdorf, M. E.; Kruger, M. J. and Oliveira, P. M. (1986) As Dimensões Morfológicas do Processo de Urbanização: uma possível e necessária metodologia de pesquisa. In: Turkienicz, B. & Malta, M. (ed.) *Anais do II SEDUR – Seminário sobre Desenho Urbano no Brasil*. São Paulo: Pini; Brasília: CNPq; Rio de Janeiro: FINEP, pp. 43 – 50.

Turner, J. (1976) *Housing by People. Towards Autonomy in Building Environments*. London, New York: Marion Boyars.

Turner, J. (1997) Learning in a Time of Paradigm Change: The Role of the Professional. In Burgess, R.; Carmona, M. & Kolstee, T. (eds.) *The Challenge of Sustainable Cities*. London: Zed Books, pp 163 – 175.

Valença, M. (2001) A view of Culture, Politics and Tradition in Belém. Natal: Departamento de Geografia, UFRN (computer file).

Valença, M (2001) *Globabitação: Sistemas Habitacionais no Brasil, Grã-Bretanha e Portugal*. São Paulo: Terceira Margem.

Valladares, L. (1978) *Passa-se uma Casa. Análise do Programa de Remoção de Favelas no Rio de Janeiro*. Rio de Janeiro: Zahar.

Valladares, L. (1983) Estudos recentes sobre a Habitação no Brasil: Resenha da Literatura. In: Vallarades, L. (ed.) *Repensando a Habitação no Brasil*. Rio de Janeiro: Zahar, pp. 21-74.

Van Dijk, A. & Figueiredo, L. (1998) A Ação do Mercado Imobiliário na Produção de Habitação Popular: Estudo na Área de Expansão de Belém. In: Amin, M. & Ximenes, T. (eds.) *Habitat nos Países Amazônicos*. Belém: UFPA, pp. 109 – 170.

Vieira, A. (1997) Housing for Diversity: Roma – Gypsies in Madrid. In Beall, J (ed.) *A City for All*. London, Zed Books, pp 120 – 125.

Villaça, Flávio (1999) Uma contribuição para a história do planejamento urbano no Brasil. In: Déak, C. & Schiffer, S. (eds) *O Processo de Urbanização no Brasil*. São Paulo: EdUsp, p. 169 – 243.

Voelkl, K. & Gerber, S. (1999) *Using SPSS for Windows Data Analysis and Graphics*. New York: Springer.

Weber (1964) Order in Diversity, Community without Propinquity. In: L. Wingo, Jr. (ed) *Cities and Space: The Future of Urban Land* .Baltimore: John Hopkins University Press.

Whyte, W. & Alberti, G. (1983) On the Integration of Research Methods. In Bulmer, M. & Warwick, D. (eds) *Social Research in Developing Countries*. London: John Wiley & Sons, p. 299 – 312.

Whytehand, J. (1988) Urban Fringe Belts: Development of an idea. *Planning Perspectives*, 3 pp. 47 – 58.

Whytehand, J. (2001) British urban morphology: the Conzenian tradition. *Urban Morphology*, 5 (2), 103-109.

Williams, K.; Burton, E. & Jenks, M. (2000) Achieving Sustainable Urban Form: Conclusions. In: Williams, K.; Burton, E. & Jenks, M. (eds.) *Sustainable Urban Form*. London, E & FN Spon, pp. 347 – 355.

Wratten, E. (1995) Conceptualizing Urban Poverty. *Environment and Urbanization*, Vol. 7, No. 1, pp 11 – 35.

Zarkovich, S. (1983) Some Problems of Sampling Work in Underdeveloped Countries. In: Bulmer, M. & Warwick, D. (ed.) *Social Research in Developing Countries*. London: Jonh Wiley & Sons, p. 101 – 108.

Zeisel, J. (1981) *Inquiry by Design: Tools for Environment-Behaviour Research*. Belmont: Cambridge University Press.

Web-sites

Brasil (1989) Constitution of the Federative Republic of Brazil. Translated and revised by Istvam Vajda, Patrícia Zimbres, and Vanira Souza. Brasília: Senado Federal. Web site www.senado.gov.br/bdtextual/Cons88/const88i.html Feb./2001.

Camarano, A. & Beltrão, K. (2000) Distribuição Espacial da População Brasileira: Mudanças na Segunda Metade deste Século. Texto para Discussão no. 766. Rio de Janeiro: IPEA. Web-site www.ipea.gov.br on 11/7/2002.

Centro de Apoio Operacional das Promotorias de Justiça de Habitação e Urbanismo (1979) LEI N.º 6.766 Dispõe sobre o parcelamento do solo urbano e dá outras providências (com alterações feitas pela Lei 9.785 de 29 de janeiro de 1999). Brasília: Ministério Público. Web-site: www.mp.sp.gov.br/CaoHabitacao/Lei6766.htm, on 30/02/2002.

Medeiros, M. (2001) A Trajetória do Welfare State no Brasil: Papel Redistributivo das Políticas Sociais dos Anos 1930 até os Anos 1990. Texto para discussão no. 852. Rio de Janeiro: IPEA. Web site: www.ipea.gov.br, on 8/4/2002.

Valladares, L. and Coelho, M (1995) *Urban Research in Latin America*. Web-site: www.unesco.org/most/valleng.htm. Accessed in Jul/2002.

Vasconcelos, R. & Cândido Jr., J. (1996) O Problema Habitacional no Brasil: Déficit, Financiamento e Perspectivas. Texto para discussão 410. Rio de Janeiro: IPEA. Web site: www.ipea.gov.br, on 8/4/2002.

Other sources

Tutorials:

McGlynn, S. (2001) School of Architecture/ PGRS. Oxford: Oxford Brookes University, September.

McGlynn, S. (2002a) School of Architecture/ PGRS. Oxford: Oxford Brookes University, April.

McGlynn, S. (2002b) School of Architecture/ PGRS. Oxford: Oxford Brookes University, June.

Interviews

Alves, E. Architect. Company of Metropolitan Development of Belém 1978/present (Chief of Advanced Offices and Coordinator of Cadastre and Plans 1983/1989; Participation in designation of areas for the Macro drainage project 1987; Director of Planning 1997/2000).

Araújo, E. Sanitation Engineer. Sanitation Municipal Secretariat, Chief of Special Projects Nucleus 1986/ 1997. Co-ordinator of Investment Projects 1997/ 2000. Co-ordinator of Belém's Pavement Strategic Plan 2001/Present. Belém: September 2000.

Cardoso, R. Civil Engineer, in charge of Quantity Surveying in the Army Building Works Commission in Belém (CRO/8) from 1986 until 1991. Belém: Fevereiro 2002.

Fares Filho, A. Architect. Urbanism Municipal Secretariat of Belém, Approval and Inspection Department 1987/1989. Urban Planning Department 1997/present. Belém: 1989.

Lima, J. Architect. Company of Metropolitan Development of Belém 1987/1994. Planning and Management Coordination (coordination of the Master Plan of Belém) 1991/1992.Planning and Management Secretariat – 1995/1996. Oxford: Oct, 1999.

Maneschy, M. B. Architect. University Federal of Pará, 1977/ present. Belém: January 2000.

Nassar, F. Architect. Housing Company of Pará State, Director of Housing Planning, 1995/2000. Belém: January 2000.

Nascimento, C . Architect. Urbanism Municipal Secretary 1988/90, Company of Metropolitan Development of Belém, president 1986/88. Housing Company of Pará State, president, 1977/1980 and 1998/ present. Belém: 24 January 2000.

Oliveira, R. Social Developer, Company of Metropolitan Development of Belém 1979/present. Since 1986 working with tenure regularisation actions. Belém: September 2000

Souza, A. Civil Engineer. Housing Company of Pará Stare, 1978/1997. Company of Metropolitan Development of Belém, director 1997/1998. City Housing Secretariat, 1998/1999. Sanitation Municipal Secretariat 1999/2000. Housing Company of Pará State, 2001/present. Belém: August 2000.

Appendix A

APPENDIX A: MAP OF CASE STUDY AREAS

(Source: CELPA, 1998; CODEM, 1998)

Appendix B

Fieldwork Questionnaire – English version

1. For how long have you lived in this district/house?

2. How many people live in your house? What is the relationship between you?

3. Where did you live before? (previous conditions, place/location)
a) Belém, same neighbourhood
b) Belém, another neighbourhood? Where?
c) Other municiality in the countryside of Pará? Where?
d) Other city in another state? Where?

4. In what type of dwelling did you live before? (previous conditions, accessibility to housing)
a) rented house/flat
b) invaded settlement
c) borrowed house/flat
d) own house

5. How many dwellers had lived in your plot before you? (moment of settlement, time)

6. What kind of acess did you have to your house/plot? (economic, acessibility, stage of settlement's consolidation in the moment of settlement)
a) purchase
b) occupation
c) exchange
d) replacement

7. What did you like in the house/ plot when you built/ bought it?

a)House	description		
Physical conditions	very important	important	not considered
Possibility of enlargement	very important	important	not considered
Affordable price/cost	very important	important	not considered
Provided flexible space	very important	important	not considered
Other			

b)plot	description		
Physical conditions	very important	important	not considered
Location	very important	important	not considered
Price/cost	very important	important	not considered
Possibility of enlargement/division	very important	important	not considered
Other			

8. Did you make any adaptation to the house/plot since then? (changes in built form)
a) yes
b) no
if yes, answer questions 7 and 8

9. What kind of adaptation (changes in built form)
a) adaptation inside existing house . Can you desribe/ show the changes you have made?
b) adaptation by additions
If there was adaptation to the house, what is the scheme of it within the plot? If there was more than one addition, state their chronologic order.

10. When did you decide to start the refurbishment of your house? (perception of natural form changes, provision of infrastructure, income accessibility)

When?	Doing what	Why?
Since you bought it		
Since there was an increase in household income		
After title regularisation		
After drainage and landfill of streets		
After landfill of the plot		
You didn't, it is still as it was when built		

11. Has the space outside your house changed during the time you have been here?
a) yes
b) no

12. If yes, how?
a) by drainage and landfill
b) by pavement
c) by provision of piped water, electricity, telephone, transport service
d) by refurbishment of the other houses
e) by introduction of other land uses (other activities)

13. Who took the initiative for the changes that have occurred outside/ in the streets? (community organization, institutional action)
a) group of inhabitants
b) inhabitants' associatons
c) politicians
d) city hall/ government

14. Where do your children go to school? Near your house?

Student	Distance in time	mean of transport	location

15. What is the means of transport that workers in your family use to get to their workplace?

Worker	Foot	Bus	Bike	Car

16. Has it always been like this? How was it before?

17. How long does it take from your house to your workplace?

Which of you?	Time	Workplace

Code:
Workplace
1. same district, 2. city centre, 3. other district than yours and city centre

18. Do any of you participate in any social organization?

Activity	Which of you	Where	How does this help you?
Religious organisation/ church			
Recreational/ social/ club			
Neighbourhood association			
Political party			

Code:
Where:
1.in the street where you live, 2.in other places inside your neighbourhood, 3.outside your neighbourhood
How does this help you:
1.financially, 2.socially, 3.gives support for domestic activities, 4.improves your general opportunities, 5.other

19. Do any of you take part in informal activities?

Activity	Which of you	Where	What for	with whom
Chats in public spaces				
Matches/ sport pratices				
Parties				
To look after children				
To work, inside the community				
To attend classes/ trainning				
Other				

Codes:
Where:
1. in/ in front of your house; 2.in another house in your street; 3. in other streets inside your neighbourhood; 4. outside your neighbourhood
What for:
1. leisure; 2. to know people (social integration); 3. control, safety of streets; 4. to have access to information; 5. for mutual assistance
With whom:
1. relatives; 2. friends; 3. neighbours; 4. strangers

20. Can you spot in the map provided the places where each of you attend these activities?

21. What kind of relationship do you have with your neighbours?
a) they are relatives
b) they are friends
c) just people you hardly know

22. Where do you have friends in this neighbourhood?
a) only in my street
b) all around the neighbourhood
c) we don't have friends here

23. Do you have friends in another neighbourhood? If so, which one?

24. Has the relationship among neighbours changed through time?

	How? Why?
For better	
For worse	
The same	

25. Where do children mostly play when they are outdoors?
a) in the street
b) on the sidewalk
c) inside empty plots
d) in the waterstreams
e) in squares or playgrounds

26. How safe do you think your children are playing outdoors?
a) very safe
b) partly safe
c) unsafe

27. What kind of risk do children have in playing outdoors?
a) to be contaminated by polluted water and soil
b) to be run down by a vehicle
c) to be beaten by other children/ youths
d) other

28. Do you plan to move out from here?
a) yes
b) no
29. Why? And if yes, where to?

30. How do you classify the physical environment where you live using the provided answers?

	Very good	Good	More or less	Bad	Very bad	
Safe						Dangerous
Beautiful						Ugly
Clean						Dirty
Well located						Isolated

31. Can you cite an example of a place which shows of these qualities?

	In the city?	In the neighbourhood?
Safe		
Beautiful		
Clean		
Well located		

32. How easy is it to explain your address to someone who has never visited your house?
a) very easy
b) partly easy
c) uncertain
d) partly difficult
e) very difficult

33. Can you indicate another old inhabitant/ neighbour for us to interviewed?

34. Can you take part in a focus group to discuss these items in more depth (to tell us about your personal experience of living here)?

35. Socio economic profile

Relationship between people in the household		Sex M 1 F 2	Age	Married 1 Single 2 Others 3	Occupation	Income	Educational level
1							
2							
3							
4							
5							
6							
7							

Codes: (to be presented in cards)

Age:	Income:	Education:	Occupation:
1. under 5 2. between 6 and 11 3. between 12 and 18 4. between 19 and 40 5. between 41 and 65 6. above 65	1. Up to 1 M.W. 2. between 1 and 3 M.W. 3. between 3 and 5 M.W. 4. between 5 and 10 M.W. 5. more than 10 M.W. 6. unpredictable/ uncertain 7. none	1. illiterate 2. primary school 3. secondary school 4. university incomplete 5. university graduate	1. employee in the public sector 2. employee – private sector 3. self employed – professional 4. self – employed – street vendor 5. daily worker 6. housekeeper, nanny 7. student 8. retired/pensioner 9. housewife 10. unemployed

Semi-structured Interviews with Local Authorities (research question 2)

Agency, institution:
Length of service:
Upgrade actions in which you took part (in any of the case study areas):
Position at the time of intervention/ upgrade action:

1. Can you describe your participation in this action (case study upgrade)?
2. How do you evaluate the achievements in this area? Have you reached the aims of your project?
3. Is it possible to differentiate socio-economic, environmental and spatial objectives to be achieved by an action like this?
4. Who would benefit? (local inhabitants, whole neighbourhood, whole city, public administration)
5. How much do you think tenure conditions have mattered in your project?
6. What kind of quidance and constraints have you encountered in your project? (policies, laws, loan conditions, local participation)
7. In what order should action have been taken during the upgrade action?
8. What do you think should be done next?

Semi-structured Interview with Inhabitants

1. For how long have you been living here?
2. Where are you from?
3. Why did you come to live here?
4. Is this place better than your place of origin?
5. Can you describe how this place was when you settled here? (streets, houses, plots, goods supply, infrastructure, relationship with neighbours)
6. How has your access to school, jobs, shops, infrastructure and leisure evolved during the time you have been here?

Fieldwork Questionnaire – Portuguese version

Senhor(a) morador(a),

Este questionário é parte integrante de uma pesquisa que visa a produção de conhecimentos a serem empregados tanto na formação dos alunos do Curso de Arquitetura e Urbanismo da UFPA quanto na reciclagem de técnicos envolvidos em trabalhos de infra estruturação de áreas alagáveis ocupadas informalmente, como também para informação de moradores que queiram avaliar modificações propostas ou realizadas nas mesmas.
O objeto da pesquisa é a investigação do relacionamento entre o espaço produzido informalmente (ocupado ou invadido) e as oportunidades de atendimento de necessidades básicas de seus moradores (tais como habitação, transporte, educação e renda). Procuramos entender o quanto caminhos, ruas, tamanho e forma de quarteirões e terrenos, etc. da área onde o (a) Sr.(a) vive lhe ajudam em sua vida cotidiana.
Sua colaboração como morador é vital para o desenvolvimento e conclusão dessa pesquisa.
As informações obtidas serão despersonalizadas, associadas a nomes fictícios sem endereços, as referências serão apenas à área em estudo e as descrições serão feitas por representação gráfica (em mapas esquemáticos). Estou a disposição juntamente com meus assistants para prestar quaisquer esclarecimentos adicionais que o (a) Sr (a) julguem necessário, sobre qualquer pergunta aqui apresentada.
Agradeço sua colaboração,

Ana Cláudia Cardoso
Prof. Assistente/ DAU/ UFPA

Estagiários: Andreia Conduru, Cinara Estrela, Carolina Amaral, Gustavo Cardoso, Hamilton Ferreira, Mônica Silva, Marcos Bittencourt e Silvana Santos.

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1. Há quanto tempo vocês vivem aqui neste bairro/ nesta casa?

2. Quantas pessoas vivem na sua casa? Qual o relacionamento entre vocês ?

3. Onde você e sua família viviam antes? De onde vocês são?
a) Belém, mesmo bairro
b) Belém, outro bairro? Onde?
c) Outra município ou povoado no interior do Pará? Onde?
d) Outra cidade em outro estado? Onde?

4. Em que tipo de moradia você vivia antes?
a) casa ou apartamento alugado
b) invasão
c) casa ou apartamento emprestado
d) casa própria

5. Qual o tipo de acesso que vocês tiveram ao seu terreno/ casa?
a) compra
b) ocupação
c) permuta
d) remanejamento

6. Quantas famílias moraram no seu terreno antes de vocês?

7. O que vocês gostaram no terreno quando o ocuparam ? *

De suas condições físicas	Muito importante	importante	não considerado
Da localização	Muito importante	importante	não considerado
Do preço/custo	Muito importante	importante	não considerado
Da possibilidade de ampliação/ subdivisão	Muito importante	importante	não considerado
Outros			

8. O que vocês gostaram na casa quando a compraram ou construíram? *

De suas condições físicas (qualidade do material, condições de manutenção)	muito importante	importante	não considerado
Da possibilidade de ampliação	muito importante	importante	não considerado
Do preço/ custo acessível	muito importante	importante	não considerado
Do potencial de adaptação à outro uso	muito importante	importante	não considerado
Outros			

9. Você fez alguma adaptação na casa ou terreno desde então?
a) sim
b) não
Se sim, responda as questões 7 e 8.

10. Que tipo de adaptação?
a) adaptação no terreno (aterro, cercamento, etc)
b) adaptação na casa (construção, ampliação, etc.)
Se houve ampliação na casa, qual o esquema dessa ampliação no lote? Se houve mais de uma ampliação indique a ordem das mesmas.

11. Quando você decidiu começar a reforma de sua casa? *

Momento	Fazendo o que? Por que?
Quando você a comprou	
Quando mudou a renda da família	
Após recebimento de título do terreno	
Após drenagem a aterro das ruas	
Após aterro do lote	
Outros	

12. A rua em frente à sua casa mudou durante o período de tempo que você vive aqui?
a) sim
b) não

13. Se sim, de que forma? *
a) por drenagem e aterro
b) por pavimentação
c) por provisão de água encanada, eletricidade, serviço de transporte
d) por reforma de outras casas
e) por introdução de outros usos (outras atividades)
f) por deterioração da infra-estrutura existente na época de sua chegada

14. Quem tomou a iniciativa de promover as mudanças que têm ocorrido nas ruas?
a) grupos de moradores
b) associação de moradores
c) políticos
d) prefeitura / governo

15. Onde ficam as escolas que vocês freqüentam?

Estudante	A quanto tempo de sua casa?	Usando que meio de transporte?	Localização da escola (endereço)

16. Qual o meio de transporte que os trabalhadores da família utilizam para se deslocarem para seus locais de trabalho?

Trabalhador	Pés	Ônibus	Bicicleta	Carro

17. Sempre foi assim? Como era antes?

18. Qual o tempo que cada um de vocês gasta neste deslocamento (de casa para o trabalho)?

Qual de vocês?	Tempo gasto	Local de trabalho

19. Algum de vocês participa de alguma organização social?*

Atividade	Qual de vocês	Onde	Como isso o ajuda?
Org. religiosa/ igreja			
Recreacional/social/clube			
Associação de bairro			
Partido político			

Código:

Onde	Como isso o ajuda
a) na rua em que vocês moram b) em outros lugares dentro do bairro c) fora do bairro	a) financeiramente b) socialmente c) dá apoio as atividades domésticas d) amplia suas possibilidades e) outros

20. Algum de vocês toma parte em atividades informais? *

Atividade	Qual de vocês	Onde	Pra que?	Com quem?
Bate-papo na rua/calçada				
Jogos/prática de esportes				
festas				
Vigilância de crianças				
Multirões dentro da comunidade				
Cursos ou treinamentos gratuitos				
Outros				

Códigos:

Onde	Pra que	Com quem
a) na frente de sua casa b) em outra casa de sua rua c) em outra rua dentro de seu bairro d) fora de seu bairro	a) lazer b) pra conhecer gente (integração social) c) controle, segurança da rua (olhos da rua) d) pra acesso à informação e) pra assistência mútua	a) parentes b) amigos c) vizinhos d) estranhos e) sozinho

19. Você pode apontar no mapa os lugares que cada um de vocês mais freqüenta no bairro (ruas, esquinas, edificações, etc.)? (ver observações e usar uma folha de papel manteiga por entrevista)

20. Que tipo de relacionamento você tem com seus vizinhos?
a) são seus parentes
b) são seus amigos
c) apenas pessoas que você mal conhece

21. Onde vocês tem amigos nesse bairro?
a) apenas na sua rua
b) por todo o bairro
c) não têm amigos aqui

22. Vocês têm amigos em outro bairro? Se têm, em qual/quais?

23. O relacionamento de vocês com os vizinhos tem mudado ao longo do tempo?

Avaliação	Como? Por quê?
Pra melhor	
Pra pior	
A mesma coisa	

24. Onde as crianças de sua casa brincam quando estão fora de casa?*
a) na rua
b) na calçada
c) em terrenos baldios
d) nos canais
e) em praças ou parques (play-grounds)

25. Como você acha que as crianças (de sua casa e conhecidas suas) estão brincando fora de casa?
a) muito seguras
b) parcialmente seguras
c) inseguras

26. A que tipo de risco as crianças (de sua casa e conhecidas suas) estão expostas brincando fora de casa? *
a) de serem contaminadas por água e solo poluído (sujos)
b) de serem atropeladas
c) de serem atacadas por outras crianças ou adolescentes
d) outros.

27. Vocês pensam em se mudar daqui?
a) sim
b) não
28. Por quê? Se sim, pra onde?

29. Como você classifica o meio ambiente físico onde você vive, dentro dos intervalos oferecidos?

amigável	muito bom	bom	mais ou menos	ruim	muito ruim	hostil
seguro	muito bom	bom	mais ou menos	ruim	muito ruim	perigoso
bonito	muito bom	bom	mais ou menos	ruim	muito ruim	feio
limpo	muito bom	bom	mais ou menos	ruim	muito ruim	sujo
bem localizado	muito bom	bom	mais ou menos	ruim	muito ruim	afastado

30. Você e capaz de citar exemplos de lugares para cada uma dessas qualidades?

Qualidade	Na cidade?	No bairro?
amistoso		
seguro		
bonito		
limpo		
bem localizado		

31. Qual é o grau dificuldade que vocês encontram pra explicar seu endereço pra alguém que nunca tenha lhes visitado? Por quê?
a) muito fácil
b) parcialmente fácil
c) incerto
d) parcialmente difícil
e) muito difícil

32. Você pode indicar outro morador antigo ou vizinho pra ser entrevistado por nós?

33. Você poderia participar de um encontro com outros moradores pra discutir esses itens de modo mais detalhado (pra nos contar a respeito de sua experiência pessoal de vida aqui)? Onde seria um bom ponto de encontro? Como podemos entrar em contato novamente?

Perfil Sócio econômico

Relacionamento das pessoas na habitação		Sexo M 1 F 2	Idade	Casado 1 Solteiro 2 Outros 3	Ocupação	Renda	Nível educacional
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Códigos:

Idade	Renda	Educação	Ocupação
a) menos de cinco anos b) entre 6 e 11 anos c) entre 12 e 18 anos d) entre 19 e 40 anos e) entre 41 e 65 anos f) mais de 65	a) até 1 salário mínimo b) entre 1 e 3 s.m. c) entre 3 e 5 s.m. d) entre 5 e 10 s.m. e) mais de 10 s.m. f) imprevisível/incerto g) nenhum	a) analfabeto b) curso primário c) primário incomp. d) 1° grau e) 1° grau incomp. f) 2° grau g) 2° grau incomp. h) universitário i) universitário incompleto	a) empregado no setor público b) empregado no setor privado c) autônomo - profissional d) autônomo – camelô, lavadeira, doceira, etc. e) diarista f) empregado (a) doméstico (a) /babá g) estudante h) aposentado / pensionista i) dona de casa j) desempregado

a)Quem ganha dinheiro na casa?

b) Descrição das condições da entrevista:

* - Mais de uma alternativa pode ser selecionada

Questionnaire Coding

1. length of time living in the area
2. number of inhabitants per household
3. relationship among inhabitants
4. place of origin
5. previous kind of household
6. kind of access to plot
7. number of previous inhabitants in the plot
8. plot convenience – physical conditions
9. plot convenience – location
10. plot convenience – cost / price
11. plot convenience – subdivision and addition possibilities
12. plot convenience – other
13. house convenience – physical conditions
14. house convenience – enlargement possibilities
15. house convenience – price
16. house convenience – potential for land use adaptation
17. house convenience – other
18. occurrence of adaptation
19. plot adaptation
20. house adaptation
21. adaptation lay-out
22. time of house refurbishment – after acquisition
23. time of house refurbishment – after household income change
24. time of house refurbishment – after title acquisition
25. time of house refurbishment – after street drainage and landfill
26. time of house refurbishment – after plot landfill
27. time of house refurbishment - other
28. changes in front of the house during the family/household's occupation of it
29. through drainage
30. through pavement
31. through piped water provision, electricity, transport
32. through other houses refurbishment
33. through introduction of other land uses
34. through degradation of infrastructure
35. changes promotion – inhabitants group
36. changes promotion – inhabitants association
37. changes promotion – politicians
38. changes promotion – city hall/government
39. student – age range
40. school location
41. student v. means of transportation
42. student v. school address
43. student v. time of displacement from house to school
44. formal work (outside)
45. worker movement on foot
46. worker movement by bus
47. worker movement by cycle
48. worker movement by car
49. transport evolution
50. time spent from house to work per worker
51. member of religious organisation
52. place
53. reason
54. member of recreational organisation
55. place
56. reason
57. member of neighbourhood association
58. place
59. reason
60. member of political party

61. place
62. reason
63. participation in street chats
64. place
65. reason
66. with whom?
67. participation in games/sports
68. place
69. reason
70. with whom?
71. participation in parties
72. place
73. reason
74. with whom?
75. participation in child care
76. place
77. reason
78. with whom?
79. participation in self-help action
80. place
81. reason
82. with whom?
83. participation in training activities
84. place
85. reason
86. with whom?
87. most visited places in the neighbourhood
88. relationship among neighbours
89. location of friends in the neighbourhood
90. location of friends outside the neighbourhood
91. neighbours relationship evolution
92. play places for children outside their houses
93. level of safety of children playing outside their houses
94. kind of danger children are exposed to outside their houses
95. intention of moving
96. reason
97. destiny
98. Classification of your environment – friendly to unfriendly
99. Classification of your environment – safe to dangerous
100. Classification of your environment - beautiful to ugly
101. Classification of your environment – clean to dirty
102. Classification of your environment – well located to segregated
103. Example of friendly in the city
104. Example of friendly in the neighbourhood
105. example of safe in the city
106. example of safe in the neighbourhood
107. example of beautiful in the city
108. example of beautiful in the neighbourhood
109. example of clean in the city
110. example of clean in the neighbourhood
111. example of well located in the city
112. example of well located in the neighbourhood
113. level of difficulty in explaining your address to a visitor
114. reason
115. number of inhabitants in the household
116. age range of inhabitants per household
117. educational level of inhabitants
118. marital status
119. occupation
120. do you earn?
121. gender/ inhabitants
122. generations living together

Tables for assimilation of data collected from questionnaires

Previous life conditions

		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V4 place of origin	Belém, same neighbourhood							
	Belém, another neigh.							
	Other municipality							
	Other city/ state							
V5 previous kind of household	Rented house/flat							
	Invaded settlement							
	Borrowed/flat							
	Own house							

Accessibility to housing/ moment of arrival in the settlement

		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V6 kind of access to plot	Purchase							
	ocupation							
	exchange							
	replacement							
V7 number of plot previous occupation	Yes							
	No							
	Unknow							
V1 time of arrival	after 1998							
	1994 to 1997							
	1990 to 1993							
	1986 to 1989							
	1982 to 1985							
	1970 to 1981							
	before 1970							
V8 plot convenience – physcal conditions	very important							
	Important							
	Not considered							
V9 plot convenience - location	very important							
	Important							
	Not considered							
V10 plot convenience – cost/price	very important							
	Important							
	Not considered							
V11 plot convenience – subdivision and addition possibility	very important							
	Important							
	Not considered							
V12 plot convenience - other	very important							
	Important							
	Not considered							
V13 house convenience – physical condition	very important							
	Important							
	Not considered							
V14 house convenience – enlargement possibility	very important							
	Important							
	Not considered							
V15 house convenience - price	very important							
	Important							
	Not considered							
V16 house conv. – potential for land use adaptation	very important							
	Important							
	Not considered							
V17 house convenience - other	very important							
	Important							
	Not considered							

Changes in the built form

			Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V18 occurence of adaptacion		yes							
		no							
V19 kind of adapta-tion	enlarge-ment	Type a							
		Type b							
		Type c							
		Type d							
		Type e							
		Type f							
		Type g							
		Type h							
		Type i							
	change of built material	Wood to bricks							
		Bricks to wood							
		Other improvments							
V20 plot adapta-tion	yes	fence							
		landfill							
		addition							
		subdivision							
	no								
V21 to 27 time of house refurbishment		After acquisition							
		After income change							
		After title acquisition							
		Drainage and landfill							
		After plot landfill							
		other							

Perception of natural form changes, provision of infrastructure

			Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V28 to 34 changes in front of the house during the family/ house-hold's occupa-tion	yes	Through drainage							
		Through pavement							
		Piped water, electricity, transport provision							
		Other houses' refurbishment							
		Other land uses							
		Degradation							
	no								
V35 to 38 promotion of changes		Inhabitants group							
		Inhab. association							
		Politicians							
		City hall/government							

Social accessibility - education

		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V39 students	Adults							
	Teenagers							
	children							
V40 school location	Inside the neighbour.							
	Out of the neighbour.							
V41 student v. means of transportation	foot							
	bus							
	Bicycle							
	Car							
V43 time of journey from house to school	Up 10 min.							
	from 11 to 20 min.							

	from 21 to 45 min.							
	More than 45 min.							

Social accessibility – 2) income accessibility

		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V44 formal work (outside household)								
V45 to 48 worker movement from house to work	foot							
	bus							
	Bicycle							
	Car							
V49 transport evolution conditions	Without change							
	With improvement							
V50 time spent from house to work	Until 15 min.							
	from 15 to 30 min.							
	from 30 to 60 min.							
	More than 60 min.							
	variable							

Social accessibility - 3) formal social organization

			Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V51 inhabitant in religious organisation	Yes	How many							
	No								
V52 place	In the street where you live								
	In another street/ same neighb.								
	Outside the neighbourhood								
V53 reason	Financial								
	Social								
	Domestic task support								
	General opportunities								
	other								
V54 inhabitant in recreational organisation	yes	How many							
	no								
V55 place	In the street where you live								
	In another street/ same neighb.								
	Outside the neighbourhood								
V56 reason	Financial								
	Social								
	Domestic tasks support								
	General opportunities								
	Other								
V57 inhabitant in neighbourhood association	yes	How many							
	no								
V58 place	In the street where you live								
	In another street/same neighb.								
	Outside the neighbourhood								
V59 reason	Financial								
	Social								
	Domestic task support								
	General opportunities								
	Other								
V60 imembership of political party	yes	How many							
	no								
V61 place	In the street where you live								
	In another street/same neighb.								
	Outside the neighbourhood								

V62 reason	Financial							
	Social							
	Domestic task support							
	General opportunities							
	Other							

Social accessibility – 4) Informal social organisation

			Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V63 participation in street chats	yes	How many							
	No								
V64 place	In front of your house								
	In another house/same street								
	In another street/ same neighb.								
	Outside the neighbourhood								
V65 reason	Leisure								
	Social integration								
	Control of street safety								
	Access to information								
	Mutual assistance								
V66 with whom?	relatives								
	friends								
	neighbours								
	strangers								
	alone								
67 participation in games/ sports	yes	How many							
	no								
V68 place	In front of your house								
	In another house/same street								
	In another street/ same neighb.								
	Outside the neighbourhood								
V69 reason	Leisure								
	Social integration								
	Control of street safety								
	Access to information								
	Mutual assistance								
V70 with whom	relatives								
	friends								
	neighbours								
	strangers								
	alone								
V71 iparticipation in parties	Yes	How many							
	No								
V72 place	In front of your house								
	In another house/same street								
	In another street/ same neighb.								
	Outside the neighbourhood								
V73 reason	Leisure								
	Social integration								
	Control of street safety								
	Access to information								
	Mutual assistance								
V74 with whom	relatives								
	friends								
	neighbours								
	strangers								
	alone								
V75 participation in child care	yes	How many							
	no								

V76 place	In front of your house								
	In another house/same street								
	In another street/ same neighb.								
	Outside the neighbourhood								
V77 reason	Leisure								
	Social integration								
	Control of street safety								
	Access to information								
	Mutual assistance								
V78 with whom	relatives								
	friends								
	neighbours								
	strangers								
	alone								
79 participation in self help action	yes / How many								
	no								
V80 place	In front of your house								
	In another house/same street								
	In another street/ same neighb.								
	Outside the neighbourhood								
V81 reason	Leisure								
	Social integration								
	Control of street safety								
	Access to information								
	Mutual assistance								
V82 with whom	relatives								
	friends								
	neighbours								
	strangers								
	alone								
V83 participation in training activities	yes / How many								
	no								
V84 place	In front of your house								
	In another house/same street								
	In another street/ same neighb.								
	Outside the neighbourhood								
V85 reason	Leisure								
	Social integration								
	Control of street safety								
	Access to information								
	Mutual assistance								
V86 with whom	relatives								
	friends								
	neighbours								
	strangers								
	alone								

Social integration

		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V87 most visited place in the neighbourhood	streets							
	squares							
	supermarket							
	church/ school							
	other buildings							
V88 relationship among neighbours	relatives							
	friends							
	people you know							
V89 location of friends in the	In the street where you live							

friends in the neighourhood	All around the neighbor.							
	Don't have							
V90 location of friends outside the neighbourh.	Yes							
	No							
V91 neighbours' relationship evolution	The same							
	For better							
	For worse							

Safety

		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V92 playplaces for children outside their houses	Street							
	Side walk							
	Empty plots							
	Water streams							
	Squares/parks							
	Back yards							
V93 level of safety of children playing outside their houses	Very safe							
	Partly safe							
	unsafe							
V94 danger children are exposed to	Contamination							
	Be run down by cars							
	Physical agression							
	Others							

Urban references

		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V95 intention of moving	yes							
	no							
V96 reason	Dissatisfaction with local conditions							
	Personal problems							
V97 destiny	Not decided							
	Other neighbourhood							
	Other municipality							
V98 classification of environment in relation to friendliness	Very good							
	Good							
	More or less							
	Bad							
	Very bad							
V99 classification of environment in relation to safety	Very good							
	Good							
	More or less							
	Bad							
	Very bad							
V100 classification of environment in relation to beauty	Very good							
	Good							
	More or less							
	Bad							
	Very bad							
V101 classification of environment in relation to cleaniness	Very good							
	Good							
	More or less							
	Bad							
	Very bad							
102 classification of environment in relation to easy accessibility	Very good							
	Good							
	More or less							
	Bad							
	Very bad							
V103 example of friendly in the city	Yes							
	No							

V104 example of friendly in the neighbo.	Yes							
	No							
V105 example of safe in the city	Yes							
	No							
V106 example of safe in the neighbourhood	Yes							
	No							
V107 example of beautiful in the city	Yes							
	No							
V108 example of beautiful in the neighbourhood	Yes							
	No							
V109 example of clean in the city	Yes							
	No							
V110 example of clean in the neighbourhood	Yes							
	No							
V111 example of well located in the city	yes							
	No							
V112 example of well located in the neighbouhood	Yes							
	No							
113 level of dificulty to explain your address to a visitor	Very easy							
	Partly easy							
	Uncertain							
	Partly difficult							
	difficult							

Socio economic profile

		Santa Casa	Santa Cruz	Tucunduba	Control 1	Paracuri	Artur Bernardes	Control 2
V115 number of inhabitants per household	until 2							
	from 2 to 4							
	from 4 to 6							
	from 6 to 10							
	from 11 to 15							
	More than 15							
V116 age range of inhabtants per household	More than 65 anos							
	from 41 to 65 anos							
	from 19 to 40 anos							
	from 12 to 18 anos							
	from 6 to 11 anos							
	Less than 5 anos							
V98 educational level of inhabitants	Illiterate							
	Primary course							
	Prim. Incomplete							
	1° grade							
	1° grau incomplete							
	2° grade							
	2° grau incomplete							
	University							
	Univ. incomplete							
V119 occupation of inhabitants	Emp. Public sector							
	Emp. Private sector							
	Autonomous prof.							
	Autonomous inform							
	Daily worker							
	Housekeeper/ nanny							
	Student							
	Retired/ pensioner							
	Housewife							
	Unemployed							
V120 income access / inhabitant	Up to 1 m. w.							
	From 1 to 3 m. w.							

		From 3 to 5 m. w.							
		From 5 to 10 m. w.							
		More than 10 m. w.							
		Unpredictable/ uncertain							
		none							
V121 gender/ inhabitant		Male							
		Female							
V122 generations living together	Yes	2 generations							
		3 generations							
		4 generations							
		other							
	no								

.....

Sample of databases

Table B.1 shown next is composed of selected variables originated from the two main databases. This selection was made to generate the maps that show some of these variables, plotted in Chapters 6 and 7.
The database which has individuals as key has a total of 26 pages (a sample of it is presented in Table B.2). The database which has households as key is constituted of several sections, divided according to the coding shown in the table for assimilation of data (p. 316-323).

The variables in the columns of Table B.1 are:
A - Identification of the household
B - Location (case study area)
C - Number of inhabitants
D - Ratio of workers to non-workers
E - Highest individual income in each household (taken from the database which has individual as key)
F - Highest individual schooling in each household (taken from the database which has individual as key)
G - Period of settlement of the present household
H - Relationship with neighbours
I - Location of friends
J - Local integration (of the street where the household is located)
K - Global integration (of the street where the household is located)
L - Depth (of the street where the household is located)
M - Street type (of the street where the household is located)
N - Street condition (of the street where the household is located)
O - Street width (of the street where the household is located)
P - Density (gross building density of the case study area)
Q - Previous plot occupation
R - House adaptation
S - Plot adaptation
T - Perception of street change

The variables in the columns of Table B.2 are:
A – Location (the sample belongs to Santa Casa case study area, represented by number 2)
B – Inhabitant (within a household)
C – Gender
D – Age
E – Schooling
F – Occupation
G – Income
H – Time of journey from home to school
I – Means of transport from home to school
J – Time of journey from home to work
K – Means of transport from home to work
L – School location

Table B.1 Selected variables originated in the two main databases

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	4	5	.600	3	4	6	3	2	2	3	2	2	1	7	42	2	1	2	2
2	4	5	.200	6	5	6	2	1	5	5	3	3	2	5	42	1	2	2	2
3	4	6	.660	5	5	6	2	2	5	5	3	3	2	5	42	2	2	1	1
4	4	9	.400	3	5	7	2	2	5	5	3	3	2	5	42	2	1	1	1
5	4	4	.500	4	5	5	2	2	2	3	2	2	1	7	42	3	2	#NULL!	1
6	4	12	.090	2	4	6	1	2	2	3	2	2	1	7	42	1	1	2	1
7	4	3	1.000	4	4	6	2	1	2	3	2	2	1	7	42	1	1	1	1
8	4	3	1.000	1	3	7	2	2	2	3	2	2	1	7	42	1	1	1	1
9	4	5	.600	4	5	7	2	2	10	8	5	4	1	2	42	2	1	2	1
10	4	4	.500	4	4	5	2	1	6	5	3	4	1	2	42	2	1	2	1
11	4	5	.600	4	4	5	2	2	10	8	5	4	1	2	42	2	2	2	1
12	4	4	.500	4	4	4	2	1	7	5	3	3	1	2	42	2	2	2	1
13	4	5	.600	4	5	5	2	2	7	5	3	3	1	2	42	2	1	2	1
14	4	6	.500	1	4	7	1, 2	1	3	5	3	6	1	5	42	1	1	2	1
15	4	4	.750	2	4	6	3	2	3	5	3	6	1	5	42	1	1	1	1
16	4	5	.750	3	4	6	2	2	6	6	4	5	2	4	42	3	1	2	2
17	4	3	.660	2	4	7	2	2	6	6	4	5	2	4	42	1	1	2	1
18	4	6	.330	3	4	7	2	2	3	3	3	2	1	5	42	3	1	2	1
19	4	5	1.000	5	5	6	3	3	3	3	2	2	1	5	42	0	1	2	1
20	4	4	.660	6	4	5	2	2	3	3	2	2	1	5	42	3	1	2	1
21	1	6	.330	1	4	6	2	2	6	7	5	4	2	2	58	1	1	2	1
22	1	1	1.000	1	1	7	2	2	5	6	4	7	2	6	58	2	2	1	1
23	1	8	.570	2	4	3	2	2	7	8	5	7	2	6	58	1	2	2	1
24	1	5	.600	2	3	6	2	2	6	7	5	4	2	2	58	3	2	2	1
25	1	7	.400	2	3	3	1, 2	2	7	8	5	3	2	2	58	2	2	2	2
26	1	4	.750	2	4	7	3	1	3	5	3	6	2	5	58	1	1	1	1
27	1	8	.375	2	4	3	2	2	3	6	4	5	2	4	58	3	1	1	1
28	1	2	1.000	1	4	7	1	2	7	6	4	5	2	3	58	2	1	2	1
29	1	2	1.000	6	4	6	2	1	8	8	6	6	2	7	58	3	2	2	1
30	1	3	.660	2	3	7	3	2	7	7	5	5	2	5	58	1	#NULL!	#NULL!	1
31	1	12	.450	2	4	1	3	2	7	6	4	5	2	3	58	1	2	2	2
32	1	2	1.000	2	2	4	3	1	7	6	4	5	2	3	58	1	1	1	2
33	1	6	.500	1	3	6	3	1	10	7	5	5	2	3	58	2	1	2	1
34	1	4	.250	6	4	6	2	3	10	7	5	7	2	5	58	1	1	1	1
35	1	19	.470	2	5	7	2	2	8	6	6	5	2	4	58	2	1	2	1

36	1	4	.250	6	4	6	2	2	10	7	5	5	2	3	58	1	1	1	2
37	1	4	.500	6	2	6	2	2	8	7	5	5	2	8	58	2	2	1	1
38	1	7	.280	2	4	5	3	2	6	7	5	3	2	3	58	1	1	1	1
39	1	4	.250	2	4	4	2	2	5	7	5	5	2	4	58	3	1	1	1
40	1	9	.375	2	3	5	2	2	5	7	5	5	2	4	58	1	1	1	1
41	1	3	.660	2	4	3	3	3	4	5	4	3	2	3	58	3	1	1	2
42	1	5	.400	3	4	6	2	2	6	7	6	6	2	4	58	2	1	2	1
43	1	4	.250	2	4	4	2	2	8	8	6	6	2	2	58	3	2	1	1
44	1	6	.500	4	5	6	3	1	4	5	4	3	2	3	58	1	1	1	1
45	1	2	1.000	2	4	1	1	3	8	8	6	6	2	4	58	2	1	2	2
46	1	5	1.000	1	3	5	2	2	7	8	7	5	4	1	58	1	2	2	2
47	1	7	.500	2	4	1	2	2	7	8	7	5	4	1	58	1	1	2	2
48	1	6	.500	2	4	4	3	2	7	8	7	5	2	2	58	1	1	2	2
49	1	5	.400	2	4	6	1	3	8	9	7	6	2	2	58	3	2	2	1
50	1	4	.500	2	3	5	3	3	8	7	5	5	2	3	58	3	1	2	1
51	1	8	.710	2	3	4	1	2	8	9	6	3	4	2	58	1	1	2	2
52	1	5	.200	2	4	3	2	2	8	9	6	3	4	2	58	3	1	#NULL!	2
53	1	2	1.000	6	3	4	3	2	7	7	5	2	2	4	58	2	1	1	2
54	1	4	.250	2	3	6	1	1	7	7	5	5	2	4	58	3	2	1	2
55	4	3	.330	2	3	2	2	2	7	6	4	5	1	4	42	3	1	2	1
56	4	3	.330	2	4	5	3	2	5	6	4	5	1	4	42	3	1	2	1
57	4	6	.500	5	5	6	2	2	5	6	4	5	1	5	42	2	2	2	1
58	4	7	.420	4	5	5	2	2	5	6	4	5	1	6	42	2	2	2	1
59	4	7	.420	3	4	7	2	2	5	4	3	3	1	5	42	2	#NULL!	#NULL!	1
60	4	5	1.000	4	5	7	2	2	5	4	3	3	1	6	42	2	1	2	1
61	4	3	1.000	5	5	7	2	1	5	4	3	3	1	4	42	2	1	#NULL!	1
62	4	7	.710	5	5	7	2	1	5	4	3	3	1	6	42	2	1	2	1
63	4	4	.750	4	5	7	2	2	5	4	3	6	1	5	42	2	1	#NULL!	1
64	4	4	.500	5	5	5	2	2	5	6	4	5	1	5	42	1	1	#NULL!	2
65	4	6	.660	4	5	6	2	2	5	4	3	3	1	4	42	2	1	2	1
66	4	2	1.000	2	4	6	2	1	5	4	3	3	1	6	42	2	1	2	1
67	4	6	.660	5	5	7	2	2	5	4	3	3	1	4	42	1	1	2	1
68	4	3	.330	4	5	6	2	2	5	4	3	3	1	6	42	2	1	#NULL!	1
69	4	5	1.000	8	5	6	3	3	2	1	2	2	1	7	42	3	1	2	2
70	4	4	.750	8	5	2	3	1	2	1	2	2	1	7	42	1	2	2	1
71	4	6	.500	1	5	5	1	2	2	1	2	2	1	7	42	2	1	2	1
72	4	6	1.000	3	4	7	2	1	2	1	2	2	1	7	42	1	1	2	1
73	4	11	.270	2	4	3	2	3	2	1	2	2	1	7	42	1	2	2	1
74	2	3	.500	3	4	2	1	2	5	7	5	7	1	8	78	1	1	1	1

75	2	5	.200	2	4	3	3	1	5	7	6	2	2	3	78	2	1	1	2
76	2	4	.330	2	4	2	3	3	7	7	5	3	2	4	78	2	2	1	1
77	2	3	1.000	1	2	1	3	2	5	7	5	5	2	4	78	2	2	2	1
78	2	4	.250	3	3	2	3	2	5	6	5	7	1	8	78	2	1	1	1
79	2	10	.500	1	4	5	2	2	6	7	5	2	1	3	78	1	1	#NULL!	1
80	2	3	.330	6	4	7	3	2	4	5	4	7	1	7	78	1	1	#NULL!	1
81	2	5	.200	2	4	5	3	3	5	7	5	5	1	4	78	2	1	1	1
82	2	6	.330	1	3	3	3	2	3	6	4	6	2	2	78	2	1	1	1
83	2	3	.330	8	5	1	3	3	6	7	5	2	1	4	78	1	1	2	1
84	2	3	.660	2	4	5	2	2	5	7	5	5	2	3	78	2	1	1	1
85	2	3	.660	7	5	4	3	2	7	7	6	2	2	8	78	1	1	1	1
86	2	1	1.000	1	4	1	3	3	4	5	4	7	1	8	78	1	2	2	2
87	2	5	.400	2	4	5	2	2	6	7	5	2	1	4	78	2	1	2	1
88	2	5	.000	7	3	4	1	2	7	7	5	5	4	2	78	2	1	2	1
89	2	5	.600	6	4	5	2	2	4	5	4	7	1	8	78	1	2	2	1
90	2	5	.600	2	3	6	3	3	7	7	6	2	2	7	78	2	1	2	1
91	2	5	.400	2	4	6	2	1	5	7	6	5	2	4	78	2	1	2	1
92	2	3	.660	6	3	2	3	3	6	7	5	3	5	1	78	2	1	2	1
93	2	7	.280	1	4	6	2	1	6	7	5	3	5	4	78	1	1	2	1
94	2	2	.500	2	5	3	2	2	6	7	5	2	1	4	78	2	2	1	1
95	2	9	.160	6	4	6	2	2	6	6	4	5	4	2	78	1	1	2	1
96	2	7	.420	6	4	4	2	1	6	7	5	2	1	4	78	1	1	1	1
97	2	4	1.000	2	4	2	2	2	6	7	7	3	5	1	78	2	1	2	1
98	2	15	.570	2	4	6	2	2	6	7	6	5	2	3	78	2	1	1	1
99	2	2	.500	2	3	3	3	3	8	8	6	4	3	2	78	3	2	2	1
100	2	7	.140	1	4	3	2	1	4	5	4	7	1	8	78	2	1	2	1
101	2	3	.330	1	3	6	2	2	4	5	4	7	1	8	78	1	1	1	1
102	2	11	.270	2	4	6	2	2	8	8	6	4	1	2	78	3	1	2	1
103	2	12	.500	4	4	6	3	3	5	6	5	6	1	3	78	2	1	1	1
104	2	11	.540	4	4	5	2	2	5	6	5	6	1	4	78	2	1	1	1
105	2	4	.660	4	4	3	2	1	6	7	5	2	1	3	78	1	1	1	1
106	2	3	.660	1	5	7	2	2	6	6	4	5	1	3	78	1	1	1	1
107	2	8	.500	3	4	3	2	2	6	6	6	3	2	2	78	2	2	2	1
108	2	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	3	2	2	78	#NULL!	#NULL!	#NULL!	#NULL!
109	2	5	.800	5	5	6	2	1	8	8	5	3	2	3	78	1	1	1	1
110	2	3	.500	2	2	5	3	2	4	5	4	7	1	8	78	3	1	2	1
111	2	4	.500	3	4	4	2	2	4	5	4	7	1	8	78	2	1	1	1
112	2	5	.200	6	4	7	2	2	6	6	5	3	1	3	78	2	1	#NULL!	1
113	2	2	.500	4	4	4	2	2	3	4	4	2	2	5	78	2	1	#NULL!	2

114	2	1	1.000	1	2	7	1	2	6	7	5	2	2	4	78	2	1	1	1
115	2	13	.500	6	4	6	2	2	4	5	4	7	1	8	78	3	1	#NULL!	1
116	3	5	.600	2	4	3	2	2	3	4	3	2	2	4	73	3	2	2	1
117	3	4	.250	6	4	1	3	3	6	7	5	5	2	5	73	1	2	1	1
118	3	6	.660	1	4	4	2	2	6	6	4	6	1	3	73	3	2	2	1
119	3	5	1.000	2	4	4	1	2	7	7	5	3	2	1	73	2	2	2	1
120	3	4	.500	1	4	3	3	3	7	7	5	3	2	2	73	1	2	2	2
121	3	5	.750	2	4	5	2	2	6	7	7	6	2	2	73	3	1	2	1
122	3	5	.200	1	3	4	2	2	7	7	6	3	3	1	73	2	1	2	1
123	3	5	.500	6	3	2	2	2	7	8	6	5	2	3	73	3	1	1	1
124	3	6	.500	2	4	1	3	3	7	8	6	5	2	2	73	3	2	2	#NULL!
125	3	6	.330	2	4	6	2	0	7	8	7	3	2	3	73	2	2	2	1
126	3	15	.500	1	4	6	3	2	8	8	7	6	2	3	73	0	1	2	1
127	3	6	.830	4	4	6	3	2	8	8	7	3	2	2	73	2	1	2	1
128	3	4	.750	3	4	5	2	1	6	7	5	6	1	3	73	3	1	2	1
129	3	3	1.000	3	4	5	1	2	7	7	5	4	2	2	73	2	1	1	1
130	3	5	.200	2	4	6	2	2	10	8	7	3	2	3	73	2	1	2	1
131	3	4	.600	2	4	2	2	2	5	6	6	5	3	1	73	1	1	2	1
132	3	7	.600	2	4	6	1, 2	2	7	7	7	5	2	3	73	2	2	2	1
133	3	5	1.000	2	3	6	3	2	9	8	6	5	2	2	73	1	2	2	2
134	3	5	.400	2	4	4	2	2	7	8	7	3	2	4	73	3	1	2	1
135	3	7	.700	2	4	2	2	2	7	7	7	5	4	2	73	3	1	2	1
136	3	4	.500	3	4	7	2	1	6	6	4	2	1	3	73	0	1	2	1
137	3	6	.600	5	4	4	2	2	8	8	6	6	2	2	73	1	1	2	1
138	3	4	.500	2	3	6	2	2	8	9	8	4	2	1	73	1	1	1	1
139	3	5	.600	6	4	4	3	2	8	9	8	5	2	4	73	1	2	1	1
140	3	7	.420	2	4	5	2	1	8	7	6	5	3	1	73	2	1	2	1
141	3	5	.660	6	4	3	2	2	7	7	6	5	2	3	73	1	1	2	1
142	3	7	.420	2	5	5	2	2	7	7	6	5	2	3	73	3	1	2	1
143	3	5	.600	6	4	5	2	2	3	8	7	5	2	3	73	2	2	2	1
144	3	3	.500	3	4	6	2	2	7	8	7	5	2	3	73	2	1	1	1
145	3	4	.500	1	4	6	2	2	7	7	5	5	2	3	73	1	1	1	1
146	3	9	.370	8	4	6	1, 2	2	7	7	5	5	2	2	73	1	1	2	1
147	3	5	.500	6	3	3	2	2	7	8	6	5	2	2	73	1	1	2	1
148	3	5	.400	1	4	4	2	2	8	8	7	5	3	3	73	1	1	2	1
149	3	7	.280	3	3	7	2	2	8	8	7	5	3	3	73	1	1	1	1
150	3	10	.550	6	5	6	1	2	9	9	8	3	2	3	73	2	2	2	1
151	3	5	.500	2	4	1	3	2	9	9	8	5	2	2	73	1	1	2	2
152	3	9	.880	6	4	6	2	2	5	7	5	6	1	3	73	1	1	2	1

153	3	7	.200	4	3	5	3	2	10	9	8	4	2	1	73	1	2	1	1
154	3	6	.600	4	4	3	3	3	6	8	6	3	2	3	73	1	1	2	1
155	7	5	.600	6	3	6	2	2	4	3	3	6	1	5	34	1	1	1	1
156	7	3	1.000	6	3	7	2	2	4	3	3	6	1	5	34	2	1	1	1
157	7	4	.500	6	4	5	3	2	4	3	3	6	1	5	34	2	2	2	1
158	7	4	.500	3	4	7	2	2	4	3	3	6	1	5	34	2	2	2	1
159	5	3	.660	8	4	4	3	2	1	1	2	2	2	7	28	1	1	1	1
160	5	4	.660	1	4	7	2	2	6	4	3	3	3	5	28	1	2	2	1
161	5	3	.660	2	3	1	1	2	6	4	3	3	3	5	28	3	2	2	2
162	5	4	.500	6	4	3	3	2	5	4	2	2	2	7	28	1	1	2	1
163	5	11	.200	6	4	6	1, 2	2	5	4	3	2	2	7	28	1	1	1	1
164	5	3	.660	2	4	6	3	2	5	7	5	6	3	7	28	1	1	1	1
165	5	7	.420	6	3	6	3	2	5	7	5	6	2	7	28	1	1	1	1
166	5	0	.500	2	4	4	2	2	6	6	5	6	2	5	28	2	1	2	1
167	5	4	.500	6	3	5	3	2	6	6	4	6	2	5	28	2	1	#NULL!	1
168	5	4	.500	1	4	4	3	2	6	6	4	6	2	5	28	1	1	1	1
169	5	5	.200	6	3	6	1, 2	2	6	6	4	6	3	5	28	1	1	2	1
170	5	3	.660	6	4	4	2	2	6	6	4	2	2	6	28	2	#NULL!	1	1
171	5	9	.500	2	4	4	2	2	4	7	5	5	2	4	28	1	1	1	1
172	5	7	.330	2	4	4	1	2	9	8	6	3	2	4	28	1	1	1	2
173	5	6	.600	3	4	2	1	2	9	8	6	3	2	4	28	1	1	2	2
174	5	2	.500	1	2	3	3	3	4	7	5	5	2	5	28	1	1	2	1
175	5	4	.250	6	3	3	3	2	6	6	4	2	2	5	28	1	1	1	1
176	5	5	.600	2	3	2	2, 3	1	6	6	4	2	2	5	28	1	1	2	1
177	5	5	.500	2	4	2	3	2	4	7	5	5	2	5	28	3	1	2	1
178	5	4	.500	6	4	3	2	2	6	6	8	2	2	5	28	1	1	2	1
179	5	2	.500	1	2	5	2	2	8	8	5	5	3	4	28	2	1	2	2
180	5	3	.660	6	4	3	3	2	6	7	5	3	2	3	28	1	1	2	2
181	5	1	1.000	1	2	2	2	2	6	6	5	3	2	4	28	1	1	2	1
182	5	7	.420	2	5	1	3	2	6	6	5	3	2	4	28	3	1	2	1
183	5	3	.660	2	3	1	3	3	4	7	5	3	2	8	28	1	2	2	2
184	5	2	.500	2	4	3	2	1	9	8	6	5	2	5	28	3	2	2	2
185	5	5	.800	6	4	3	2	2	8	7	4	2	2	4	28	2	1	1	1
186	5	3	.660	2	4	2	1	2	9	8	6	5	2	5	28	1	1	1	1
187	5	5	.500	6	3	4	1, 2	2	9	8	6	4	3	2	28	2	1	2	1
188	5	5	.250	1	4	4	2	2	9	8	6	5	3	4	28	2	2	1	1
189	7	7	.000	6	3	3	2	2	6	7	6	5	2	7	34	3	1	2	1
190	7	4	.250	6	4	1	2	1	6	7	6	5	2	7	34	1	2	2	1
191	7	6	.500	2	4	2	2	2	7	8	6	5	2	5	34	2	1	#NULL!	1

192	7	0	.250	2	3	2	2	2	6	7	6	5	2	5	34	2	1	2	1
193	7	4	.500	1	3	2	3	2	7	7	6	5	2	5	34	2	1	2	1
194	7	4	.250	1	3	2	2	2	6	7	6	5	2	5	34	2	1	2	1
195	7	#NULL!	#NULL!	#NULL!	#NULL!	0	0	0	#NULL!	#NULL!	#NULL!	5	2	5	34	0	#NULL!	#NULL!	#NULL!
196	7	10	.600	6	4	3	1, 2	2	6	7	6	5	2	5	34	2	1	2	1
197	7	2	.500	3	4	2	2	2	6	7	6	5	2	5	34	2	2	2	1
198	7	#NULL!	#NULL!	#NULL!	#NULL!	0	0	0	6	7	6	5	2	5	34	0	#NULL!	#NULL!	#NULL!
199	7	5	.500	2	3	1	3	1	6	7	6	5	2	5	34	1	2	2	2
200	7	7	.280	3	4	1	2	2	6	4	4	5	2	5	34	1	1	2	2
201	7	3	.660	2	4	3	2	2	6	7	6	5	2	5	34	2	2	2	1
202	7	3	.660	3	4	2	3	2	6	7	6	5	2	5	34	2	1	2	1
203	6	3	1.000	2	4	2	2	2	4	4	3	1	1	8	75	1	1	2	1
204	6	4	.330	6	4	2	3	2	6	7	5	2	3	2	75	2	2	2	1
205	6	4	.750	4	4	3	2	2	7	7	5	3	2	2	75	2	1	2	1
206	6	5	.400	6	2	1	3	3	6	7	5	2	2	4	75	1	2	2	1
207	6	5	.600	1	3	1	2	2	7	6	4	2	2	4	75	1	2	2	1
208	6	4	.500	2	4	1	2	2	5	7	4	2	2	5	75	2	1	1	1
209	6	5	.250	6	3	1	2	2	5	7	5	2	2	3	75	0	1	1	1
210	6	4	.000	8	4	2	2	2	6	7	5	3	3	3	75	2	2	2	2
211	6	5	.000	6	3	1	3	3	7	6	4	2	4	4	75	2	2	2	1
212	6	3	.330	6	4	2	3	3	6	7	5	2	4	2	75	0	2	2	1
213	6	5	.250	2	2	2	1, 2	2	5	8	6	2	3	2	75	1	1	1	1
214	6	2	.500	1	3	2	3	3	7	6	5	2	4	4	75	2	2	2	1
215	6	2	.500	1	2	1	2	3	6	7	5	3	4	5	75	2	2	2	1
216	6	5	.330	1	3	2	1, 2	3	7	9	6	2	4	7	75	2	1	2	2
217	6	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	1	1	8	56	#NULL!	#NULL!	#NULL!	#NULL!
218	6	5	.250	3	4	1	3	3	4	6	4	1	1	8	56	1	1	2	2
219	6	3	.660	2	3	1	3	1	8	8	6	2	3	5	56	3	1	2	2
220	6	3	1.000	2	4	1	2	2	7	7	5	2	2	5	56	2	1	2	2
221	6	0	.660	2	4	6	3	3	7	7	5	2	2	5	56	1	1	2	1
222	6	3	.500	7	2	1	3	3	8	8	5	2	3	7	56	3	2	2	1
223	6	5	.250	6	3	2	1	2	7	7	5	2	3	4	56	2	1	1	1
224	6	3	1.000	2	3	1	2, 3	2	7	7	5	2	3	5	56	1	1	2	2
225	6	4	.330	1	3	2	3	2	9	8	6	1	1	8	56	3	2	2	2
226	6	6	.330	6	3	1	3	3	9	8	6	1	1	8	56	1	1	1	1
227	6	1	1.000	1	2	2	2	2	9	8	7	2	5	1	56	2	2	2	1
228	3	7	.500	1	2	6	2	2	7	7	7	5	2	3	73	2	2	2	1
229	3	10	.370	2	4	1	0	0	10	#NULL!	8	4	3	2	73	1	1	1	1
230	3	3	.660	4	3	6	2	2	5	7	6	5	4	2	73	2	1	2	1

231	3	7	.710	2	4	6	3	1	5	7	5	6	1	4	73	2	1	1	1
232	3	4	.750	6	2	#NULL!	#NULL!	#NULL!	8	9	8	5	2	3	73	#NULL!	#NULL!	#NULL!	#NULL!

Table B.2 Sample of database having individuals as key (data from Santa Casa case study area)

A	B	C	D	E	F	G	H	I	J	K	L
2	21	2	4	4	7	7	3	1	0	0	1
2	21	2	3	4	7	7	1	1	0	0	1
2	21	1	2	2	7	7	1	1	0	0	1
2	21	2	3	2	7	7	1	1	0	0	1
2	21	1	4	1	4	1	0	0	1	1	0
2	21	2	5	3	4	6	0	0	1	1	0
2	22	2	6	1	8	1	0	0	0	0	0
2	23	2	5	1	4	6	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
2	23	2	4	4	4	2	0	0	2	2	#NULL!
2	23	2	3	3	7	7	3	2	0	0	2
2	23	2	2	3	7	7	1	1	0	0	1
2	23	1	4	3	7	6	3	2	0	0	2
2	23	1	1	1	0	7	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
2	23	1	4	6	1	8	0	0	2	2	#NULL!
2	23	1	5	6	4	6	0	0	4	5	0
2	24	1	4	3	2	2	0	0	1	2	0
2	24	1	5	6	8	2	0	0	1	2	0
2	24	1	4	3	2	2	0	0	2	2	0
2	24	1	3	3	7	7	1	1	0	0	1
2	24	1	4	3	7	7	1	1	0	0	1
2	25	1	4	6	4	6	0	0	1	2	0
2	25	2	5	3	4	2	0	0	2	2	0
2	25	1	2	3	7	7	1	1	0	0	1
2	25	2	3	3	7	7	1	1	0	0	1
2	25	2	3	3	10	7	0	0	0	0	0
2	25	1	1	1	0	7	0	0	0	0	0
2	25	1	1	1	0	7	0	0	0	0	0
2	26	2	4	4	2	2	0	0	2	2	0
2	26	2	6	2	8	1	0	0	0	0	0
2	26	2	4	4	1	2	0	0	1	2	0
2	26	2	2	3	7	7	1	1	0	0	1
2	27	2	4	4	8	1	0	0	0	0	0
2	27	2	6	2	9	2	0	0	0	0	0
2	27	2	2	3	7	7	1	1	0	0	1

2	27	2	2	3	7	7	1	1	0	0	1
2	27	2	1	3	7	7	1	1	0	0	1
2	27	1	4	4	4	1	2	2	3	2	2
2	27	1	4	4	1	2	0	0	#NULL!	#NULL!	0
2	27	2	4	4	7	7	1	1	0	0	1
2	28	1	4	4	3	1	0	0	2	3	0
2	28	1	6	2	8	1	0	0	2	3	0
2	29	1	5	4	3	6	2	1	1	1	1
2	29	1	4	3	3	6	0	0	1	1	0
2	30	2	4	3	3	2	0	0	1	3	0
2	30	1	5	3	10	7	0	0	0	0	0
2	30	2	3	3	7	7	1	1	0	0	1
2	31	1	5	4	1	2	0	0	3	2	0
2	31	2	5	3	2	1	0	0	1	1	0
2	31	1	4	4	6	6	0	0	1	1	0
2	31	1	3	3	7	7	1	1	0	0	1
2	31	1	3	3	7	7	3	1	0	0	1
2	31	2	2	2	7	7	3	1	0	0	1
2	31	2	4	4	1	1	2	2	1	2	2
2	31	1	1	1	0	7	0	0	0	0	0
2	31	2	1	2	7	7	2	1	0	0	1
2	31	2	2	2	7	7	2	1	0	0	1
2	31	2	2	2	7	7	2	1	0	0	1
2	31	2	4	3	6	6	0	0	#NULL!	#NULL!	0
2	32	2	5	2	3	2	0	0	6	0	0
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Sample of Coding of Interviews with Technicians

City hall action	1970s: produced Belém's waterlogged areas monograph (first diagnosis, as follow up to a city master plan, was in this monograph) 1980s: back to previous diagnosis, proposal of big scale drainage plan. Rationale: insufficiency of urban services and equipment. A canal would change waterlogged areas inhabitants' lives.
State and Federal Government Action	1972: proposal to recover waterlogged areas, financial sustainability based on sale of recovered land, engineering proposal to benefit speculation. Suspended after technical appeal. Request for alternative (given as above in the 1980's)

Nascimento/2000

Federal Agency Loan Standards	Unclear justification for established standards, over-dimensioned to apply to invasion areas' reality
Reasons for increase of invasion	Natural increase of established population (backyard occupation), migration caused by rural areas' inhabitants search for better opportunities, rather than by expulsion forced by countryside landowners
Pre 1980's struggles' networks	Invasion of federal land + left wing organisation + political parties action + progressive church support
Technicians' support	Technicians' action protected by professional institutions used as a facade Struggle against land use regulation (transposition of formal standards to informal areas) The proposal was cancelled.
Politicians' action	New names took advantage of the rights of property struggle. Once the reaction of landowners to land invasion had faded, the beginning of the invasion industry occurred. Once the left-wing was empowered, community organisation was replaced by political manipulation by leadership from above. Invasions as policy (left-wing). Opportunism, clientelism.
Institutions created during the process	CBB (Belém Districts Committee)+ communitarian centres + federation of communitarian centres

Nassar/2000

Government action in Paracuri	First case of compensation by estate government Physical and legal regularisation (after physical and socio economic survey) Avoidance of complete vegetation removal
Characteristics of actions	Social matters – political aim School as a symbol (others could not be provided due to shortage of financial resources) Disconnected action and financial distribution of resources due to politically motivated budget time schedules. Inversion of technically correct order of action due to time and condition of loan access. Technicians are 'disposable'
Criticisms	There is a habit of carrying out the most complex solution. This is more often put into effect, even if the simplest is the best. At Paracuri: poor quality of water provided, due to the system's inadequacy; urban provision has not considered demand of users just outside the area; limitation of construction Fear of technicians of either being fired or losing position if they go beyond political interests Low-esteem of technicians, need for staff qualifications and institutional development Lack of integration between city hall offices, lack of interdisciplinarity, lack of continuity of aims Waste of inhabitants' knowledge about their habitat Each works to his/her own advantage more than to the public interest Political fight between municipality and state government
Institutional v. personal action	Loose institutional surveillance allowed personal action (extension of works and close contact with inhabitants in Paracuri)
Cultural matters	Need to make inhabitants aware of environmental matters, and be their best preserver
Private sector	Action of service providers – e.g.: provision of electricity before settlement assessment. It formalised the informal just to increase number of consumers

Souza/2000

Sample of Coding of Interviews with Inhabitants

Arthur Bernardes 1 (Central Park, Joana D'Arc Street) – a gentleman was interviewed
Arthur Bernardes 2 (Central Park, Cabral Street) – a shopkeeper was interviewed
Arthur Bernardes 3 (Arthur Bernardes Road) – Mr. Sacola, a communitarian leader at Guará invasion. He tells the history of Guará's occupation. According to him there were inhabitants living in that place more than 20 years ago. It was abandoned for 20 years, and because of that it became a hiding-place. Criminals used to attack pedestrians, women, cyclists from the rivers' bridge. The previous inhabitants were staff of a company located at the opposite side of the road. It was called Guará, and as it had crashed they moved house. He decided to call the settlement Guará because of this fact.
There has been only a bar for all these years there, which belongs to a friend of his. The place was too unsafe. As they have been living in the surroundings and needed houses, they decided to organise an invasion. There were speculators interested in selling the plots afterwards, but it was his duty to tell them off, saying that they didn't have the right to sell plots because the land didn't belong to them. The land belongs to the federal government because it is located on a river bank. He states that they had occupied the area because of the invaders' need to have a house and to inhibit violence.
Guará invasion is different from the other located next to it (Central Park). There, plots are sold. He said that he had done many things: opened streets, bought wood, etc., moved by social intentions. By the time of occupation, everything was defined - plot size, width of streets and lay-out, which were his responsibility. He has shown himself sensitive to environmental issues such as vegetation and clay preservation. There was no technical advice, work was based on self-help actions and there are still other people interested in moving into the area.

Variables	Arthur Bernardes 1	Arthur Bernardes 2	Arthur Bernardes 3
Time of residence	5 years	4 years	Not said: he organised the invasion
Origin	Same district	Other district	Same district
Migrant	No	No	No
Previous house	Rented house	Not owned (probably rented)	Probably owned house
Kind of access	Occupation	purchase	He said he was already an inhabitant
What was bought	-	The plot	-
Kind of value	Use value	Use value	use value
Evaluation of previous house	Better place (paved street)	Not said	-
What was found	Mud, grass, flooded land, each person had to clean his/her plot to occupy it	Plots with 8 x 14 m and 7 x 14 m. Two ladies led settlement organisation. Houses of 1 room, covered with canvas	An abandoned place
struggles		Rumour of reaction, support from a local politician. Occupation of invaded plots by third parties	To regularise, to avoid speculators, to improve infrastructure
Who remains		Most invaders have left; they have sold their plot	30 invaders' families. Most original invaders have given up.
Access to street landfill	Local contribution raised among those who coud afford it	Local contributions, parties to raise money to purchase landfill and to built raised wooden walkways. City hall follow up two years later	Local contribution, self-help among inhabitants and, at election time, through politicians action
Infrastructure	Time 2 years - Electricity, thanks to fires caused by clandestine connections No water provision, only wells	List of inhabitants' names to claim electricity and water. Improvisation of drainage in flood plots. Electricity provision 1 year and 2 months ago (clandestine connections before). No piped water. This family has a well which provides free water for 30 other families	Biggest problem – water provision. Some wells are good, but others are contaminated. Wished they had basic sanitation. They have electricity, but still insufficient.

Public space maintenance	Inhabitants' work	No reference	Concern with safety. There is moral censorship and search for sponsorship from industries (one has built a police lodge, and has allocated place for inhabitants' parties organised to raise money)
House improvements	Settlement – houses are similar due to same level of poverty. His house has been refurbished, he added a comment that he explores during weekends	After 1 year, houses were built with wood	Houses have been built with bricks and mortar
Violence	There is no safety, robbery, fights, murder	No reference	Transit violence, action of criminals
Neighbours	People too poor	They have a shop, and have Icoaraci, the village nearby, as main reference	
Pollution	High contamination level – rats, snakes, rubbish.		
Education	Most children don't go to school, closest school located in Icoaraci	No complaints about places and distance	Poor quality, they have to go to further places and depend on transport
Health	Deficient service. Too many diseases	Poor quality of service	He ensures care through politicians, because the HC is inefficient
Food supply and services	Emergency supplier only, high prices due to small quantities of purchased	What they don't sell themselves, they buy at Icoaraci market which is a bit far, but has better prices	
Transport	Close bus stops, but buses don't run very often	Recent improvements, more buses and new routes, but quantity is not enough yet	
Community org./ self help	Lack of organisation	There is self-help among neighbours	Active in communitarian centre. They prepare projects to look for sponsorship. Politicians don't help more because of party conflicts (have their requests vetoed by opposition)
nursery	-	Do not have one	Do not have; children are on streets
Leisure	Children play in the mud	River beaches in Icoaraci and closest countryside	Just the street space
Jobs	High unemployment due to lack of education	A few work in industries nearby; most inhabitants work in the city centre. 'It's easier to find a job here than in other places'	Santa Maria (local industry) attempts to offer work places to inhabitants
Improvements outcome	Perhaps, food vendors along the road, aim: to provide meals for staff of companies based in front.	Better neighbours; there were many criminals before	They are waiting for drainage to replace wood by bricks
Intention to move	Yes	No	-
Was it worth remaining for such a long time?	Not really, lack of alternative, they would like to live in front of a paved street	Yes, here he owns a house, and has a shop; it means a better life for his family	-

Appendix C

Fieldwork Observation charts:

Timetable

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Morning – time to attend churches	Early morning – time to leave home towards school and work	Midday	Late afternoon - time to return home from school and work	Early morning – time to leave home towards school and work	Late afternoon - time to return home from school and work	Morning – time to go to open markets
Mid afternoon	Mid morning	Mid afternoon	Evening (early)	Mid morning	Evening (early)	Late afternoon

Annotation table:

Weekday:	Date:
Time of observation:	Length of time of each action :
Who is in the street?	
Doing what?	
With whom?	
What is the existing relationship between actors?	
What is the socio cultural context?	
Where? (description of the place which must be identified in the aerial view)	
Physical traces:	

Use one table for each action observed along the route.
Plot the action in the tracing paper on top of your aerial view.

Field Observation notes (condensed)

Santa Casa

Saturday Morning (from 8:20 until 9:23)
Time for shopping, people are shopping in the open market and surrounding streets. Many shops are open along the main routes to the market corner, and so are stalls. They sell all kinds of meat and vegetables. Vendors are moving around pushing carts with goods to sell.
There are house building works in progress in the area.

Sunday Morning (from 7:55 until 8:30)
Commercial activities are less intense, a few stalls are open and fewer people are shopping.
A watchman is in charge of the school building.
Many people are partying and drinking beer in a bar.
Teenagers chat seated on the sidewalk.
People pray inside a church.
A lady sweeps the sidewalk in front of her house and a man cleans the street of building works rubbish.

Sunday Afternoon (from 15:45 to 16:18)
Stalls of snacks are open at the outermost corner.
A football match takes place in the school grounds.
Walking vendors sell regional snacks, holding trays.
Many people party in front of and into some houses.
People drink, chat and play snooker in the bars.
A man cleans his car, another cleans the street of building work rubbish.

Tuesday Mid-day (from 12:30 until 13:20)
Street vendors are seated beside their stalls waiting for customers; they sell candies. Others are tidying the stall of manioc flour, to start sales, while another one is moving his kiosk into a house and unloading the goods.
Building material shops are closed and empty carts are parked in front of them.
Football players are sawing pieces of wood to build wooden goalposts.
A few people are drinking and listening to music.
A man is cleaning building work rubbish from the street and taking them to landfill his house.

Wednesday Morning (from 7:45 until 9:36)
Street vendors are selling candies, lollies and snacks in stalls in front of the school.
A few children wearing uniforms play with a ball in front of the school.
One boy and a woman are pushing a cart, a man is pushing a loaded cart, cartmen are loading their carts in front of the sawmill.
More than 20 people are coming from the open market.
An aged woman arrives at a humble house by taxi. The lady alights with the help of the woman who accompanies her.
Many children are playing in front and inside the houses. They play with pots, table tennis and a sort of table football.
There are stalls of candies and gambling (jogo do bicho). Street vendors sell dry prawns and fruits from carts.
Customer transports shopping bags in a cargo bike.
House building works are in progress. Men are chatting on the canal bank.
The rubbish collection is about to start and electricity consumption is being measured.

Friday Afternoon (from 16:35 until 17:50)
Street vendors are selling chips, candies and popcorn in stalls in front of the school.
Walking children are selling snacks on trays.
A couple chat in a gambling stall.
Adults chat and eat snacks at the corner.
Cartmen play chequers on a cart, others watch them.
A well-dressed lady leaves a villa.
A man washes his house veranda and also hoses the street to settle the mud powder down.
Another man fixes the sidewalk in front of his house.
A vendor cleans his stall to start his sales. There is a stall of savoury snacks open at the inner corner.
Children play table tennis on the street, men play snooker in a bar.
A young man pushes a girl in a wheelchair. A police car rides around.
A manicurist paints a lady’s nails in a house protected with a railing. Girls play with elastic bands on the street.

Women wearing only tiny shorts and bras (presumably prostitutes) are seated around a bar table with a man.

Tucunduba
Sunday Morning (from 7:45 until 10:00)
Vendors sell herbs, cigarettes, crabs, etc. in stalls on the main street.
A boy is preparing a can to carry mortar in a building work; he is nailing a piece of wood onto one of its sides.
People are going to the Protestant church holding bibles.
People mounted on bikes meet to depart together.
Fruit shops are opened, snacks are delivered by bike to small shops.
House repairs are in progress (one man shapes a screen to protect the house against the rain, others carry sand to add to mortar).
People watch the street from their houses: a man on a bike carries two racks of 24 bottles of beer.
People chat on the street while working and at shop counters.
A drunken man rests against a lamppost. Other men fix a pipe leak on the street.
Three young men load wood on a cart. Men are chatting, drinking and listening to music in the avenue.

Sunday afternoon (from 16:00 until to 17:00)
All stalls are closed in the avenue. People are watching the street, seated on chairs in the sidewalk or chatting.
Bars are crowded by people drinking, and some people drink and chat loudly on the sidewalk.
Stalls of chips, tacacá, candies and savoury snacks start to be assembled.
A lady serves customers from inside a shop through the railing that protects it.
It is drizzling, and people make small repairs to wooden walls to protect them against water.
People play snooker in a bar, children play in the middle of the street.
People are seated on chairs eating tacacá in front of a stall.
People play cards on a house veranda.
There is service in progress in the church.
A man washes his car in the middle of the street.
Boys are flying kites on a house's slab (working as a roof while the second floor was not built), where the second floor is going to be built.
Many children play and adults chat and watch the movements on the street.
The bar and the stalls selling spirit are crowded. People also drink on a house veranda.
Many people pass by, while a girl is taking water from a pipe located bellow the raised wooden walkway.
The bike garage is open; two men are working inside.
Groups of children play football and table tennis on the street.
There are lots of building sites with uncovered slabs (working as roofs) in the area; the families use these surfaces to sit in the evening to watch the movements on the street and to chat.

Monday Morning (from 8:15 until 10:00)
On the main street a woman assembles a watchmaker stall, helped by a boy; other vendors are selling vegetables, seasoning and cigarettes.
On the inner street, a woman is watering pots of plants suspended in a window; a young man and a boy do carpentry work preparing a building site, a man is seated in front of a house, watching the movement.
One boy is flying a kite in the street and a car equipped with speakers moves around, announcing Christmas sales.
People watch two carpenters polishing furniture.
A boy is writing, other children are playing and adults are seated around. One boy who was cleaning a ditch joins a group of people chatting.

Tuesday Afternoon (from 16:25 until 17:18)
The stalls are still assembled in the main street. One man seated in a wheelchair drinks and chats with a middle aged man leaning on an empty stall.
Two men are drinking and chatting. The butcher crosses the street to serve a customer.
A boy is delivering timetables of gas distribution to inhabitants.
Pastry is sold in a gambling stall.
Twelve children are playing football in the middle of the street; in the next street ten boys suspended their football match to buy pastry from a vendor who had just arrived.
At the following corner another group of eight boys play football.
A couple is watching the street movements.

Tuesday Noon (from 12:15 until 13:25)
Street vendors are dismantling their stalls; one young man is sweeping the sidewalk.
Four men are seated around a table, playing dominoes and chatting.

Another group sing and drink while a man is playing drums and rattle.
A vendor is fitting an improvised rain cover on his stall of candies.
A wall that sets a plot limit is just completed.
People chat and perform domestic tasks (feeding a toddler, fixing a motorbike).
A vendor serves a customer in an açaí shop.
One young man is pushing a wheelbarrow full of wood alone, another man comes to help him.
Two young men are playing cards in a small shop
Six men work together in a garage.
Five students (wearing uniforms) walk towards the school.

Santa Cruz
Sunday Morning (from 9:00 until 9:55)
A group of vendors sell ingredients to prepare tacacá from stalls. A customer mounted on a bike arrives to buy starch.
People are chatting.
A girl is hand-washing clothes on a house veranda, using water from the street pipe.
A boy scout arrives and then leaves house quickly by bike, another boy also leaves home.
Two men are drinking and chatting, watched by a boy.
Four men are playing snooker in a bar, watched by another man.
A man and a boy are slaughtering chicken to serve customers.
Fruit vendors rest seated in the wheelbarrow wherein they carry oranges and watermelons.
A girl is listening to very loud music in a studio.

Monday Morning (from 8:53 until 10:00)
A girl is waiting for the bus on the opposite side of the street to protect herself against the sun. When the bus comes she crosses the street and catches it.
A male vendor is seated beside a stall of fruits and vegetables.
One lady is washing the sidewalk, using bucket and broom.
Clothes are drying on a line in front of a house.
Two men are unstopping a street drain.
One man is fixing a telly; there is a sign on the door saying that electronic appliances are mended in the house.
A group of people chat, a group of boys is reading a newspaper seated at the canal rail.

Tuesday Noon (from 12:55 until 13:40)
A group of children wearing school uniform are walking to school.
One man is cleaning his workplace (of blood and chicken feathers).
One woman, about to leave, is giving instructions to another woman in the house.
A worker of the Electricity Company talks to an inhabitant.

Friday Evening (from 17:50 until 18:30)
Four young men are seated on the canal rail, chatting with another one who is mounted on a bike.
Six children are playing football and three girls are playing with elastic bands in the street.
Two boys are chatting seated in front of a house.
A vendor is frying and selling chips; he is serving three customers.
Twenty children are playing, riding a bike and running on the street.
A vendor sells fish in a cool bag on a stall.
One young man is organising his barbecue stall in front of a house.
Eight men are playing cards and drinking around a table in a bar.
Seven children are playing hopscotch on the street; one child is watching from a bike.
Twelve boys are playing volleyball; two boys are waiting for their turn. When a car comes, they take the net off.
Fifteen children are playing football on the street.
One man is opening a trailer holding snacks.

Saturday Morning (from 8:50 until 9:55)
A vendor is cutting and weighing fish to a customer; he works from a cool bag and scales in a wheelbarrow.
A boy is carrying a plate of soup to the butcher.
A vendor is seated on a tomato box, waiting for customers.
A girl is looking for acai in a shop, without success.
One girl is washing clothes on a house veranda using water from a street pipe.
There is service in progress in the Protestant church.
One man is transferring building material from the front of the house to inside.
Four adults are looking after five children who are playing on a wheelbarrow.

Four people are eating soup, drinking beer and chatting in a house.
One cobbler is working and chatting with a woman who is drinking coffee.
Four boys are seated on a house step chatting and smoking.
One woman is spreading clothes on an airer and chatting with two people.
Two boys are carrying cast-offs from the street to a house backyard to landfill it.
The rubbish vehicle ran along Cipriano Street without collecting the rubbish bags placed in front of the houses.
One checker from the water supply company walks along the street, registering the buildings.

Saturday evening (from 18:40 until 19:05)
One young man is working from a stall; he prepares snacks for three other young man who are waiting.
One girl is frying chips on a stall; she chats with a lady.
One woman is smoking and looking after a barbecue in front of a bar.
One man is drinking, one lady is seated watching two children dancing.
One man is carrying a bed in a wooden wheelbarrow.
Four young men are playing football while two others wait for their turn.
Two men are playing snooker in a bar while another watches them.
A girl is working from a stall selling snacks. The trailer is always closed; it opens just on Saturday evenings.
There are eight people seated in front of a house, buying and eating chips. There are chairs and a frying pan as equipment.
A vendor of barbecue is serving a customer, one child is watching and two men arrive. There is a butcher at this place during the day.

Paracuri
Sunday Morning (from 6:45 until 8:15)
A boy is trimming the grass while four men are drinking and watching him from the bar.
There is a stall of vegetables close to the bus stop; many people are buying (fish was sold from the stall later).
Cows are moving along the street, a boy runs away from them.
People are queuing in front of a well to take water.
A man is buying ‘tapioquinha’ for breakfast.
A group of well dressed teenagers walk along the street holding bibles.
A drunk man seated in front of the school is teasing walkers.
A man is slaughtering a chicken.
A woman is cleaning her plot.
Another drunken man is lying on the ground.

Thursday Morning (from 7:15 until 9:15)
Men are trading clay close to the bridge; the clay is brought by boat and taken away by cart.
A man is fixing a bike in a bike garage placed on a house veranda.
A clothing shop is opening.
A company car is riding around, looking for an address.
Children walk towards the football field.
Children go by bike to the school.
A man is transporting bread on a bike.
Many children are waiting for the time to enter the school; they go away after being informed that there was no class that day.
Children returning home scream to colleagues ‘don’t walk up to the school’.
A woman washes clothes, a baby girl plays around.
Pottery is drying.

Friday Evening (from 17:15 until 18:25)
Children walk towards the school.
Men drink and chat at the sidewalk.
A group of adults chatting call a vendor to buy ‘tapioquinha’.
Groups of men chat on the street, another group is drinking in a bar
Children are playing in a house setback, other children are chatting, seated on the ground.
Children are playing on a veranda while a woman is rocking a baby in a hammock.
Women chat through windows, men chat on the street.
Teenagers are playing football in the football field.
Evangelists are talking to a man while he works.
A woman washes dishes in front of a house, another woman helps a handicapped man to walk.
A young man carries pottery in a backpack, another balances two chairs on a bike.

A woman sells barbecue. Children play. The evangelists wait for someone.
There is a culture fair in the school; people watch the movement.

Saturday Morning (from 8:08 until 10:22)
A craftsman is giving pottery to a man in a pottery workshop.
Two men watch the street from a veranda.
A woman spreads bed linen to dry in front of a house.
The school watchman watches the street and talks to a few passers by.
A couple is trimming the grass in front of a house.
Groups of teenagers play cards, dominoes, table tennis, and table football in a big shack.
There is a football contest at the football field; the football players are boys organised in teams.
People chat (they are mounted on bikes and walking).
An aged man is selling vegetables on a table on his house veranda; he and the school watchman watch the street.
A boy is taking water from a shared well.
A woman is selling candies and chatting with a man seated besides her.
The first football match finishes, teenagers start to play, and children either go away or play besides the playfiled with a ball.
Children play in a house setback.

Saturday afternoon (from 16:50 until 17:20)
Children improvise a volleyball net on the street, in front of the big shack; a woman sells candies in a stall near to them.
A boy goes to buy something at the small corner shop, ordered by an adult.
People mounted on bikes chat briefly.
Children play in front of a house, on its setback, watched by an adult.
People have a lively chat in front of a house.
Girls chat on the street.
Adults chat and drink while children play.

Arthur Bernardes
Sunday Morning (from 6:50 until 8:00)
Central Park (first settlement)
Side streets are empty.
A new father holds a baby at the corner. A woman leaves home, holding bags.
Children play on the sidewalk, watched by adults from indoors.
Sand obstructs the street; people are buying bread, others are arriving by bus, chatting and using the public telephone.
Drunken men from the previous night are still drinking in a bar.
Six people are queuing to take water from a well.
Guará (second settlement)
People chat in front of a garage, others go to the church.
Men carry wood and water in wheelbarrows.
Drunken men are still drinking, people are leaving by bike, many people are taking water from the wells.
Children are playing, a woman washes dishes in a ‘jirau’.
There is movement in the shops.

Sunday Afternoon (from 14:25 until 15:20)
Central Park
Someone is moving house. Children play on the street watched by adults from indoors.
People lie down on hammocks on verandas; others chat.
Men play snooker in a bar, women watch telly through a neighbour’s window.
People take water from a well.
People wait for a bus.
Guará
People eat and watch a football match in a snack bar. Men drink in a bar.
Men leave by bike. Children play, people sleep in hammocks, others chat.

Tuesday Mid-day (from 12:10 until 13:20)
Central Park
Children are going to school. Others are playing on a veranda.
Men are drinking, seated in a bar. People are arriving by bike.

People are queuing to buy ‘acaí’; carts sell charcoal.
A woman is taking water from a well. Other women are carrying water.
Men are building houses. Teenagers play snooker.
A woman washes clothes, teenagers chat.
Guará
Children are playing in front of the garage. People queue to use the public phone.
Woman is taking water from a well, a neighbour watches her. People are leaving home.
Wood donated by a politician to build walkways is being delivered.
Men work on a building. Children sell water from a cart.
A child is going to school. People go to Icoaraci by bike to buy ‘acai’.
A carpenter and a broom maker are working in their houses.
Children are bathing in the river, watched by a man.

Friday Afternoon (from 16:10 until 18:00)
Central Park
A man is trimming the grass, approached by two people.
Some people are leaving home.
One young man knocks on a door; as nobody comes to answer, he climbs in the window.
A child plays on a veranda, children play on the street, another child trims the grass.
Children are going to the football field, holding a ball.
One man covered with a towel leaves a house and goes to the well next door.
One man is building a ladder in front of a house; next door a group is chatting.
Eight children and three adults make several groups. Some are running, others are chatting, waiting for the time to start the football match.
Guará
One man carries wood in a bike; two others are chatting close to the wall.
A young man places rubbish bags at the opposite side of the road.
One man is working in a garage. Four men leave the company opposite to the settlement; youths chat in front of a shop seated in an improvised bench.
Five men are drinking beer at the snack bar.
A woman and three children leave a street moving towards the road. A motorbike comes later.
Children play in the street. Mums look after babies chatting.
Children take water from a well; a man shaves himself on a veranda.
Men work on a building site, people wait for the bus at the bus stop. Two men are chatting in a bar.

Saturday Afternoon (from 16:30 until 18:00)
Central Park
Four women are queuing outside the hairdresser’s; at the bike garage, two men are fixing bikes and four are queuing.
Three children play on a small board with wheels in the middle of the street. Five children climb on the hill of clay placed in the middle of the street, close to the beginning of the raised wooden walkway. The clay is going to be used to landfill a street’s flooded section.
Couples are walking up the street; people indoors chat with people outdoors through windows and verandas.
A child trims grass; children play in front of a house; people leave houses by bike, at the bakery a bike is loaded with bread.
Children play on the sand of a building site; the sand is place in the middle of the street.
Many people watch the street. Men are working inside the garage.
Guará
A man who delivers water is pushing his cart, another is using the public phone; the restaurant and the open market are closed.
People eat in a snack bar. People chat, seated on the ground, standing, walking.
Men play cards and drink in a bar. On a building site a man carries wood.
The carpenter is manufacturing furniture and carpentry.
People watch the gorgeous sundown from their houses. Children bathe in the river close to the bridge.

Tables of Movement Flow

The tables C1 to C4 show the values of movement flow, counted over ten minutes at monitoring points established along the field observation routes. The data related to Santa Casa unfortunately was lost and cannot be presented here. There were difficulties in producing comparable material for the different areas, due to availability of time, of researchers and climatic conditions. The observation took place during the months of October to December (December is the start of the rainy season). Monitoring points are plotted in Map C1. The points 3.3 and 4.1 correspond to location of street markets.

Table C.1 Santa Cruz movement flow along field observation route

Time	Point 3.1	Point 3.2	Point 3.3	Point 3.4	Point 3.5
Friday (evening)	Cars: 0 Bicycles: 24 (cyclists 26) Pedestrians: 54 Motorcycles: 0 Carts: 0				Cars: 8 Bicycles: 20 (cyclists 23) Pedestrians: 39 Motorcycles: 0 Carts: 0
Saturday (noon)		Cars: 8 Bicycles: 20 (cyclists 23) Pedestrians: 39 Motorcycles: 0 Carts: 0	Cars: 1 Bicycles: 6 (cyclists 7) Pedestrians: 21 Motorcycles: 0 Carts: 1		
Saturday (evening)				Cars: 2 Bicycles: 23 (cyclists 28) Pedestrians: 56 Motorcycles: 1 Carts: 0	
Saturday (morning)			Cars: 1 Bicycles: 16 (cyclists 18) Pedestrians: 63 Motorcycles: 0 Carts: 1		Cars: 4 Bicycles: 17 (cyclists 20) Pedestrians: 32 Motorcycles: 1 Carts: 2
Sunday (morning)			Cars: 0 Bicycles: 16 (cyclists 19) Pedestrians: 110 Motorcycles: 0 Carts: 1		

Table C.2 Tucunduba case study area's movement flow along field observation route

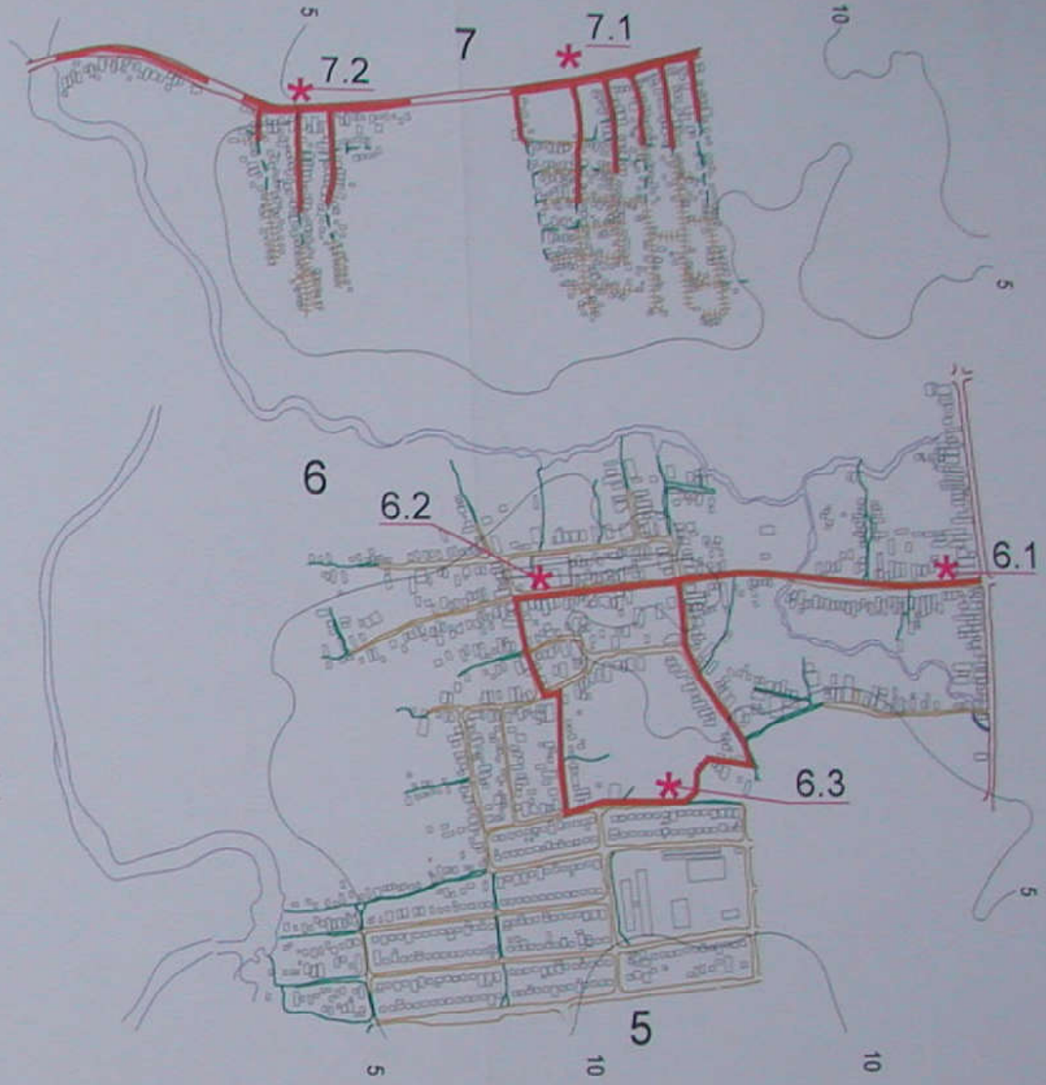
Time	Point 4.1	Point 4.2	Point 4.3
Monday (morning)	Cars: 17 Bicycles: 45 (cyclists 49) Pedestrians: 137 Motorcycles: 1 Carts: 0	Cars: 3 Bicycles: 13 (cyclists 16) Pedestrians: 59 Motorcycles: 2 Carts: 1	
Tuesday (noon)	Cars: 12 Bicycles: 57 (cyclists 64) Pedestrians: 98 Motorcycles: 3 Carts: 0	Cars: 1 Bicycles: 17 (cyclists 17) Pedestrians: 38 Motorcycles: 1 Carts: 0	Cars: 6 Bicycles: 31 (cyclists 34) Pedestrians: 98 Motorcycles: 0 Carts: 2

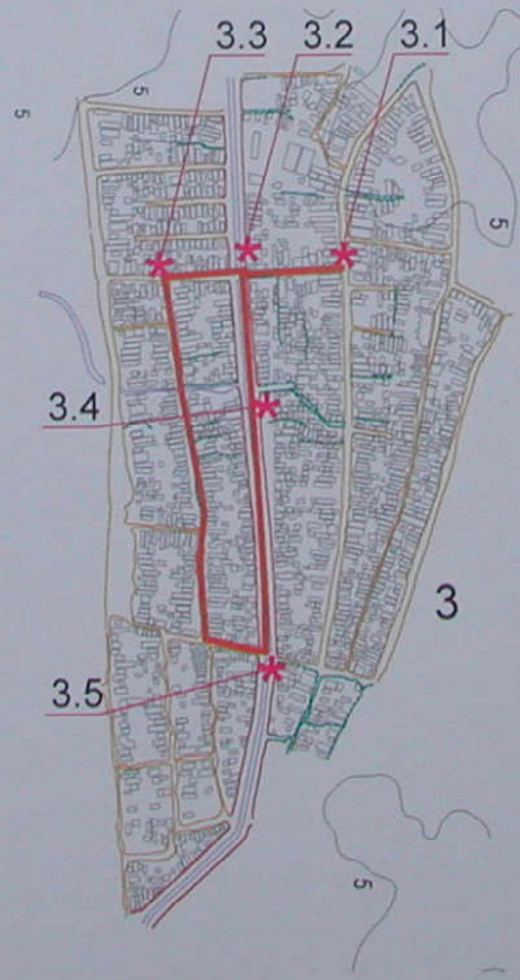
Table C3 Paracuri case study area's movement flow along field observation route

Time		Point 6.1	Point 6.2	Point 6.3
Monday (noon)		Pedestrians: 34 Bicycles: 36 Cars: 10	Pedestrians:35 Bicycles: 17 Cars: 0	Pedestrians: 9 Bicycles: 5 Cars: 0
Wednesday (afternoon)		Pedestrians: 30 Bicycles: 30 Cars: 3	Pedestrians: 45 Bicycles: 38 Cars: 0	Pedestrians: 5 Bicycles: 5 Cars: 0
Thursday (morning)		Pedestrians: 45 Bicycles: 45 Cars: 0	Pedestrians: 26 Bicycles: 26 Cars: 0	Pedestrians: 9 Bicycles: 7 Cars: 1
Friday (evening)		Pedestrians: 30 Bicycles: 35 Cars: 1	Pedestrians: 23 Bicycles: 10 Cars: 0	Pedestrians: 12 Bicycles: 5 Cars: 0
Saturday	am	Pedestrians: 38 Bicycles: 43 Cars: 1	Pedestrians: 6 Bicycles: 4 Cars: 0	Pedestrians: 15 Bicycles: 5 Cars: 0
	pm	Pedestrians: 15 Bicycles: 15 Cars: 0	Pedestrians: 6 Bicycles: 6 Cars: 0	Pedestrians: 12 Bicycles: 10 Cars: 3
Sunday	am	Pedestrians: 20 Bicycles: 30 Cars: 0	Pedestrians: 21 Bicycles: 15 Cars: 0	Pedestrians: 8 Bicycles: 5 Cars: 0
	pm	Pedestrians: 12 Bicycles: 10 Cars: 0	Pedestrians: 12 Bicycles: 12 Cars: 0	Pedestrians: 12 Bicycles: 8 Cars: 0

Table C4 Arthur Bernardes' movement flow along field observation route

Time	Point 7.1	Point 7.2
Sunday (morning)	Cars: 22 Bicycle: 24 Pedestrians: 13	
Sunday (afternoon)	Cars: 24 Bicycles: 26 Pedestrians: 8	Cars: 34 Bicycles: 17 Pedestrians: 10
Tuesday (noon)	Bicycles: 65 Cars: 84 Pedestrians: 17	Cars: 60 Bikes: 31 Pedestrian: 10
Wednesday (morning)	Bikes: 25 Cars: 56 Pedestrians: 28	Bikes: 23 Cars: 47 Pedestrians: 12
Friday (afternoon)	Cars: 52 Bikes: 26 Pedestrian: 6	Bikes: 46 Cars: 58 Pedestrians: 9
Saturday (morning)		Cars: 62 Bikes: 34 Pedestrians: 17





FIELD OBSERVATION

FIELD OBSERVATION ROUTES

* MONITORING POINTS OF MOVEMENT FLOW

CASE STUDY AREAS

1. CONTROL 1
2. SANTA CASA
3. SANTA CRUZ
4. TUCUNDUBA
5. CONTROL 2
6. PARACURI
7. ARTUR BERNARDES

FIG. C 1: MAP OF FIELD OBSERVATION ROUTES WITH MONITORING POINTS.

Source: CELPA, 1998; CODEM, 1998

N

0 100 200 300 m

Appendix D

Appendix D

Notes about Brazilian household profiles

In general terms, according to Berquó (2001), most present-day Brazilian households are still composed of nuclear families, but the trend is decreasing (78.8% in 1970 to 70.7% in 1990). Families of single parents are increasing (from 10.3% to 17.5% during the same period) as is the proportion of one-person households (8.1% in 1995). Households with more than seven people are the most unusual, followed by those of five and six people. The most usual are those with three to four people, followed by those with two people. This is explained by the variable composition of families over time, affected by fertility rates, time of marriage, divorce, remarriage and migration patterns, (80% of the Brazilian population was living in cities by 2000; even the Amazon is an urbanised forest) (Berquó, 2001, Thery, 2001).

Brazilian fertility rates have decreased from 5.5 children per family to 2.3 over the 20th century, while life expectancy has increased by 35 years during the same period. It is 67 years at present, while the Brazilian population over 60 years of age has multiplied 25 times. However, these rates are not uniform all over the country; there is a difference of 7 years in life expectancy between the richest region (Southeast) and the poorest one (Northeast), and of 46 fewer deaths of babies under one year per thousand live-born babies (Berquó, 2000).

The average number of schooling years among the whole population is 5.6, but it is just 1.2 among people over 60, and among the latter 42% are illiterate (illiteracy rate in the whole population is 17%). Most elderly also live in households with a maximum income of one minimum wage per capita. As ageing advances, the proportion of females increases (e.g. there are 180 women to each 100 men over 90 years old old). The proportion of old single women living alone is increasing (20%), while most old males (78%) share life with a wife (just 34,7% of old women have a living husband).

Furthermore, unlike eastern countries (Beal, 1995), the Brazilian poor do not live in extended families and suffer a smaller impact from religious exactions (the majority is Christian) . There is no gender prejudice within families against female children, although women are far from having official support for childcare and domestic tasks. Women usually are in charge of domestic work and have to cope with the lack of water supply and a hazardous environment for children. When they do not have a partner, they also have to earn an income to support their children, confirming the world trend of female poverty (Wratten, 1995; Amis, 1995; Moser, 1998).